

Design News

**Manifold deflects water stream to
steer and reverse jet boat. P. 8**



NONDESTRUCTIVE INSPECTION DEVICES SEEK OUT MINUTE FLAWS —help New Departure make better bearings!

One such device is the *N/D Ball Scanner*. As eagle-eyed instruments, they subject balls coming down the lines to the closest scrutiny. With unfailing consistency, they automatically reject balls having the minutest traces of rust, pits, grind marks, blemishes, and other faults, normally undetected by visual inspection. Result—balls made by New Departure are more defect-free than ever before. Bearings assembled with these balls and used in your products deliver better performance with greater reliability.

Development of nondestructive inspection devices has long been one of New Departure's principal R & D efforts. The Ball Scanner is just one of the existing devices that are already bringing you higher quality and more reliable bearings. Others are still under "wraps," but are destined to bring you even better bearings in the near future.

The advantages of these ball bearings are available to you now. Contact the New Departure Sales Engineer in your area. New Departure, Division of General Motors Corporation, Bristol, Connecticut.



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Design News

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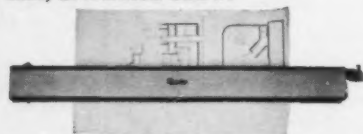
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SOUNDING BOARD

FOR OUR READERS



Value Engineering

Appearing in your issue of DESIGN NEWS of Nov. 10, 1961, (Vol. 16, No. 23) are two editorials, one signed by you and the other by R. E. Meyers. As these two editorials deal with value assurance and the large cost reductions that may be achieved by design engineers who are disciplined in the techniques of Value Engineering, I would like to have permission to reproduce and to distribute them to supervisors and design engineers. Credit, of course, will be given to your publication.

We, at Aerojet, believe that for maximum effectiveness Value Engineering must be practiced at the design, research and development phase of the product cycle. All too often when an item or part is qualified, the design is frozen. In addition, low quantities of any one assembly preclude drastic Value Analysis.

To have your permission to reproduce these editorials will aid me in getting the value assurance message across to our design engineers.

R. L. DENIG, JR., Manager
Value Engineering
Solid Rocket Plant
Aerojet-General Corp.
Sacramento, Calif.

• Permission granted.

Value Engineering

Your recent comment and "Guestitorial" on Value Engineering are very interesting.

The basic philosophies agree with mine as expressed in the enclosed article which was published almost exactly three years ago when I was with Arma.

FREDERICK J. KIRCH
81 Lincoln Rd. S.
Plainview, N. Y.

Hydraulic Bolt Tensioners

We have noted with interest in DESIGN NEWS, Nov. 10, in the "Mechanical Ideas" section, a bolt tensioner manufactured in Sweden. We have been in the business and hold American patents on hydraulic bolt tensioners since 1955 and have supplied units capable of exerting bolt loads of over 2,000,000 lb. The equipment is manufactured by us, uses standard hexagon or round nuts, and the only variation to the stud is that we require 3/4 of a diameter of effective thread on which to mount the tensioners. The Swedish design leaves a slot in the side of the housing for the operation of a spanner wrench or some other means of tightening the nut after the stud is elongated. Our housing contains a nut-turning device actuated by a key which gives a much more uniform control as to the amount of torque which can be applied to the nut.

We also have developed the procedure whereby large bolts on a reactor head can be tensioned with only one tensioning per stud rather than several tensionings as might be required with a torque wrench or impact tool.

F. H. STILLMAN, Vice Pres.
Biach Industries, Inc.
210 South Ave. E.
Cranford, N. J.

'Governmentese'

Your editorial about "Governmentese" touched a sore spot in our language. This kind of murderous treatment of all languages is not confined to a specific group of people, but is something like a sickness which becomes a bit epidemic from time to time. If there are no men to fight against it, we will sink hopelessly into a perfect mess. Only the "experts", "esoterics", "adepts" or whatever you wish to call them will be able to read and interpret the illustrious brainchildren, while the open-mouthed, admiring, ignorant masses will resort to asking those well-instructed wise men to represent them—obviously for a decent fee.

... During long years of practice as an engineer and a patent agent, I found that basically engineers (as a group) were not the originators of this manner of expression. It was and is the people who practice law.

... We who have to cope with the condition spend more than 3.3 man hours you mention in your editorial writing the nonsense so that the combination of technical and law men in the Patent Office will accept it.

I agree that we did not learn how to write properly in the Institute of Technology, but that is no reason why it should not have improved after 40 years. I also agree with your statement that it does not take a genius to write in simple terms.

CARL H. RINGE
29 Holland Pl.
Hartsdale, N. Y.

Optical Scanners

Am interested in obtaining any new literature, technical papers or books recently published concerning "optical scanners".

If you can provide the sources of this material, it will be greatly appreciated.

Your magazine rates at the top of the approximately 20 trade magazines I receive.

G. ZUMBACH
Chief Engineer
Hulse Mfg. Co.
15 Lewis St.
Geneva, N. Y.

• Tear sheets of items involving optical scanners were mailed to Mr. Zumbach.

Tariffs and Isolation

High tariffs are dead. Some people don't know it yet, but they are. The European Common Market has killed them—no matter how long it takes Congress to make it official.

It is hard to imagine the impact this will have on American industry. Some segments of it will disappear; some will gain huge markets; few, if any, will remain unaffected.

For many engineers, the death of high tariffs will mean relocation, new fields of design and abandonment of cherished practices. In short, we will have to compete—in design perhaps more than in production. We will be forced to design our machinery and consumer products in direct competition with those of our allies overseas. The products of our industries must be designed not only to sell here in competition with similar foreign ones, but also to sell abroad. We must think about exporting as well as selling in our own markets. Numerous industries have already built plants overseas for just this purpose. Many others have license agreements with similar industries overseas. This trend is not likely to be reversed.

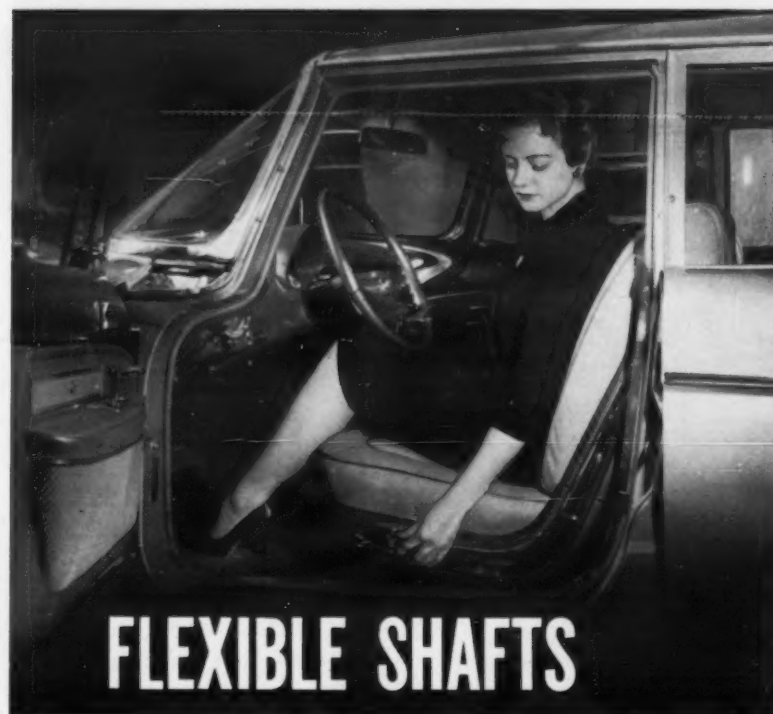
What does this mean to the engineering profession? It means that engineers need a broader outlook. It means they may have to learn other languages. It means they will need greater flexibility in their thinking. It means they will need a greater adaptability to change.

It does not mean we will need to design cheaper products. Nor does it mean we need to "cut corners" at the design stage.

It means simply that products will have to be designed for more value for the ultimate customer—and this is just good engineering—nothing more, but also nothing less.

J. P. Dubois

Executive Editor



solve space problems in power seat

Here's why Chrysler Corporation uses flexible shafts in its six-way motion, power operated seat adjuster:

1. **SPACE ECONOMY** . . . "flexible shafts provided means to transmit power from a single electric motor, without compromising seat design."
2. **REDUCED STRESSES** . . . "flexible shafts act as torsion bars to reduce motor armature stresses induced when the mechanism was stopped or stalled suddenly."
3. **RELIABILITY** . . . "not a single shaft fatigue failure reported from the field to date."
4. **LOW COST** . . . "flexible shafts definitely represented savings without sacrificing design advantages."

Investigate for yourself how flexible shafts can solve many of your design problems and at the same time reduce costs!

**S. S. WHITE INDUSTRIAL DIVISION,
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THE S. S. WHITE FLEXIBLE SHAFT HANDBOOK
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S. S. White

FIRST NAME

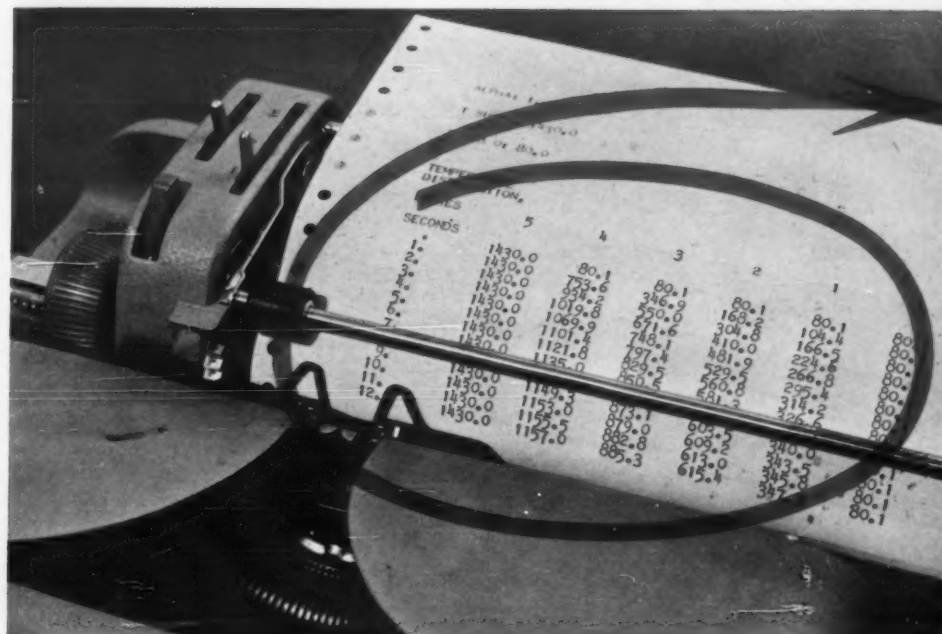
IN FLEXIBLE SHAFTS



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Computers Replace Estimating With Analysis

Edward W. Schrader, Western Editor



OPERATOR at Recomp computer. Desk-style computer may be placed in any engineering office. Transistorized portable computer uses magnetic memory disc with 4096-word capacity.

Digital computers have two basic areas of application: (1) in data processing and (2) in problem solving. Electronic data-processing types are characterized by accounting and business use, where a large volume input requires a small amount of computation and makes small decisions with a large volume output.

The second type may be described as the engineering or problem-solving digital computer. Here the input may best be described as "large", in the sense of the number of variables supplied and the number of equations involved. A large number of variables and equations requires a large volume of computation and decision making. The output is small; the answer is supplied in a series of values, which may function in terms of a variable.

This type of computer is primarily an engineering tool to free the design engineer from the drudgery of computation. The computer allows the engineer to replace estimating with more accurate analysis.

Simple heat-transfer problem

In many engineering studies, it is desirable to know how temperature is distributed in a structure. Frequently, the distribution must be known in both space and time. A very rapid change in temperature

might induce thermal stresses sufficient to cause the structure or the entire operation to fail.

As a simplified model of a general interest system, consider the computations for the space and time distribution in a high-temperature insulation block.

Assume the entire system to be at an initial temperature of 80°F. Suddenly the interior wall is raised to 1430°F by the ignition of fuel oil.



It is desirable to know the temperature at each point 1, 2, 3 and 4, as a function of time. It is also desirable to know the time elapsed before attainment of steady-state conditions.

The basic heat transfer equation in one dimension is:

$$\frac{\partial T}{\partial t} = \frac{k \partial^2 T}{\rho C \partial X^2}$$

Where T = temperature, deg F

k = conductivity, Btu/hr/deg F/ft²/inch

ρ = density, lb/cu ft

C = specific heat, Btu/lb/deg F

t = time, seconds

X = distance, inches

The constant, α , is a value which is dependent upon the specified insulating material. It may be defined as:

$$\alpha = \frac{\rho C (\Delta X)^2}{k}$$

If $\Delta X = 1$ inch, and finite difference techniques are applied, the original partial differential equation becomes four ordinary differential equations of the form:

$$\frac{dT_1}{dt} = \frac{1}{\alpha} (T_2 - 2T_1 + T_0)$$

$$\frac{dT_2}{dt} = \frac{1}{\alpha} (T_3 - 2T_2 + T_1)$$

$$\frac{dT_3}{dt} = \frac{1}{\alpha} (T_4 - 2T_3 + T_2)$$

$$\frac{dT_4}{dt} = \frac{1}{\alpha} (T_5 - 2T_4 + T_3)$$

In a typical program set-up, the temperatures

ALPHA: 1.0
 T SUB 5: 1430.0
 T SUB 0: 80.0
 TEMPERATURE DISTRIBUTION

INCHES	5	4	3	2	1	0
SECONDS	TEMPERATURE, DEGREES F					
1.	1430.0	80.1	80.1	80.1	80.1	80.1
2.	1430.0	753.6	346.9	168.2	104.4	80.1
3.	1430.0	934.2	750.0	304.8	166.5	80.1
4.	1430.0	1015.8	671.6	410.0	224.6	80.1
5.	1430.0	1069.9	748.1	481.9	266.8	80.1
6.	1430.0	1101.4	797.4	529.5	295.4	80.1
7.	1430.0	1121.8	829.5	560.8	314.2	80.1
8.	1430.0	1135.0	850.5	581.3	326.6	80.1
9.	1430.0	1143.7	864.1	594.7	334.7	80.1
10.	1430.0	1149.3	873.1	603.5	340.0	80.1
11.	1430.0	1153.0	876.0	609.2	343.5	80.1
12.	1430.0	1155.5	882.8	613.0	345.8	80.1
13.	1430.0	1157.0	885.3	615.4	347.3	80.1

SAMPLE PRINT-OUT using Recomp computer for illustrative heat transfer problem.



computed are accurate to 0.1F. In the particular equation there is the restriction that $T_s > T_0$. α is limited between 0.5 and 1.5.

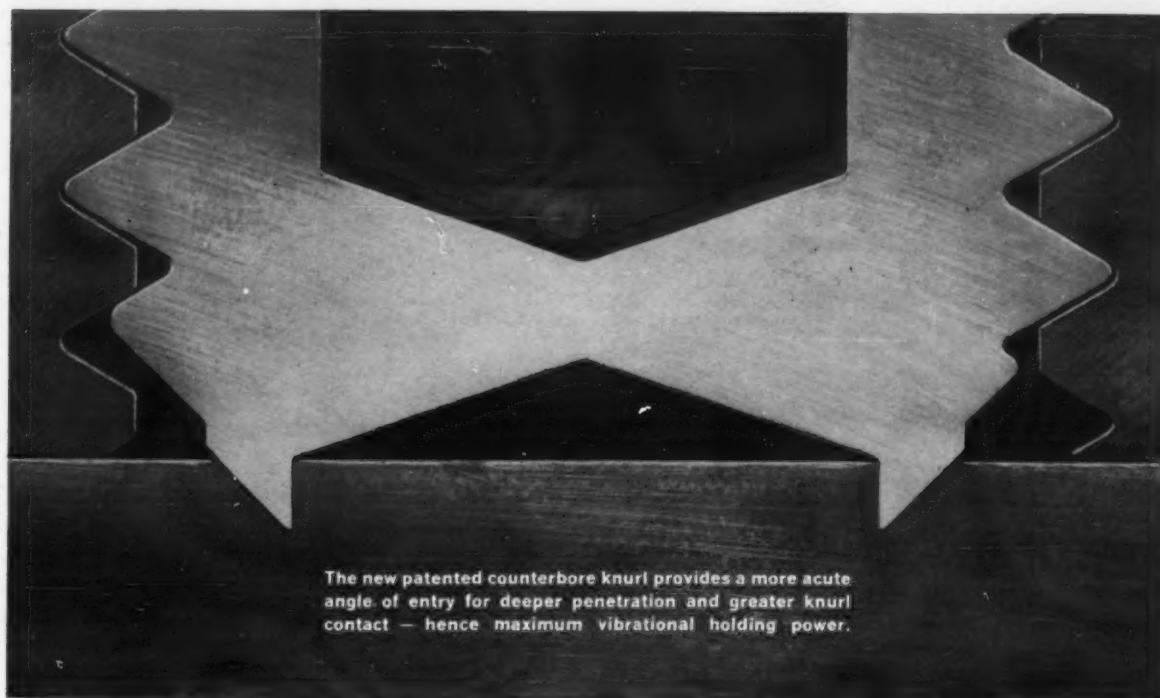
Push a few buttons and the answer prints out as illustrated.

Programming

Such an example may be preprogrammed if the type of computation is repetitive in the engineering department. If the computations are not repetitive, an engineer may perform the programming for the equations used.

Manufacturers of computer equipment state that they can train an engineer to do his own programming for special equations in a two-day instruction period. Programming essentially means learning the symbolic forms on the typewriter input to represent the algebraic symbols and mathematical manipulations. Actually, it is more a case of learning the sequence in which operations are intelligently performed by the machine and the proper buttons to press on the typewriter to perform these operations.

Technical information for the heat transfer problem was supplied by Industrial Products Div. of Autonetics, North American Aviation, Inc., Downey, Calif.



The new patented counterbore knurl provides a more acute angle of entry for deeper penetration and greater knurl contact — hence maximum vibrational holding power.

NOW! Vibrational holding power hits a new high!



... which means that your designs can now become even more *reliable*, for the new UNBRAKO set screw with patented* counterbore knurl is "the one that won't work loose." What's more, you gain in *simplicity* (no need to use two screws since one will do the job) and in *flexibility* (no need to use a permanent pin fastening where you'd prefer a readjustable set screw).

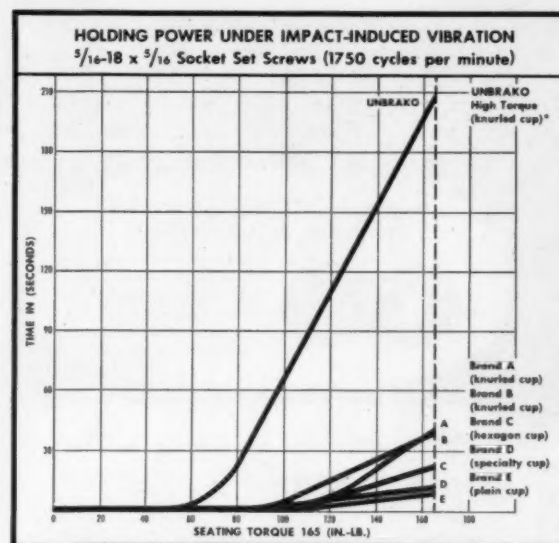
The new UNBRAKO High Torque is two ways tighter than any other socket set screw. First, the new counterbore knurl produces deeper shaft penetration. This is precisely what you need and want in order to achieve positive locking action *before*... and unparalleled vibrational holding power *at* the recommended seating torque.

Second, UNBRAKO's seating torques are up to 40% higher than those of ordinary set screws, and the tighter a screw is wrenching the greater its holding power. Behind UNBRAKO's higher torques:

- Exclusive Hi-Life thread root that distributes stress concentration at critical area
- Fully formed threads with metal compressed into a closely knit grain structure
- Deeper sockets for maximum key engagement and wrenching power
- Precision heat-treated steel to eliminate brittleness or decarburization

As you can see from the graph, the new UNBRAKO offers vibrational holding power no other set screw can begin to achieve—throughout the entire torquing range.

The new UNBRAKO High Torque Set Screw—with counterbore knurl and Hi-Life threads—is available in sizes #4



through 1 in. Your authorized UNBRAKO distributor has a complete supply on hand now. Where shaft penetration is undesirable, specify UNBRAKO with Nylok.† For a copy of our new booklet on UNBRAKO High Torque Set Screws, write to Standard Pressed Steel Co., INDUSTRIAL FASTENER DIVISION, SPS, JENKINTOWN 6, PENNSYLVANIA.

*No. 2,992,660—patented July 18, 1961 †T.M. Reg. U.S. Pat. Off., The Nylok Corp.

SPS

where reliability replaces probability

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DIAMOND

"FIRSTS"

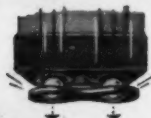
in the development of Roller Chain

FIRST TO PRE-LOAD PRODUCTION ROLLER CHAIN



Pre-loading seats pins, bushings and linkplates; takes out initial stretch.

FIRST TO BALL DRIFT



Pitch holes in DIAMOND chain sideplates are ball drifted for greater fatigue resistance—(DIAMOND patent).

FIRST TO PROPERLY PLACE BUSHINGS



Bushing seams on DIAMOND roller chain are always placed away from load-bearing area for improved resistance to wear and fatigue.

FIRST TO STUDY FATIGUE



First to make design changes in roller chain parts for improved fatigue resistance.

FIRST TO EMPLOY SEAM RELIEF BUSHINGS



OIL RESERVOIR

Seam relief bushings in roller chain reduce run-in time and provide better lubrication—(DIAMOND original patent).

FIRST TO SHOT PEEN



DIAMOND chain parts . . . rollers, bushings, linkplates and pins . . . are shot peened for greater fatigue resistance.

DIAMOND Roller Chains are the product of more than seventy-one years of specialization in the manufacture of high endurance roller chain. Some of the quality features developed and pioneered by DIAMOND are considered "extra" or "premium" features in other chains. These are standard in DIAMOND Roller Chains . . . and have been for years. DIAMOND will continue to improve the capabilities of its product, assuring you *always* of a thoroughly dependable chain with superior operating characteristics.

DIAMOND CHAIN COMPANY, INC.

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Offices and Distributors in All Principal Cities

DIAMOND



ROLLER CHAINS

SEEN AND HEARD

E. J. Stefanides, Central States Editor

WHERE DO YOU GO FROM HERE

The letter reads, "After having successfully passed the written examination in Mechanical Engineering given by the Board you are advised that the State Registration Board for Professional Engineers has granted you a certificate as 'Professional Engineer' and you are hereby entitled to practice engineering in this state."

You're too excited to bother reading the rest of it which is merely a listing of the particular legislation involved and instructions for procurement and use of the official seal.

Actually, being a good engineer, you were never really in doubt as to the results, but now it's official. The only thing really bothering you is, "Where do I go from here?" Just what effect is this going to have on your professional activities and conduct?

Fundamentally, you realize you are the same engineer you were yesterday, the only difference being that you have been officially recognized as meeting the minimum requirements for private practice in your state. It also means that you are now a member of a rather select minority group within the engineering profession, a group which is virtually nonexistent insofar as the people outside the engineering profession are concerned.

HISTORICAL PRECEDENT

Vaguely you feel that this is some sort of a turning point in your professional life and that there should be at least a subtle change in your professional manner and attitudes. Being an engineer, you look for something in the existing art as a guide, some sort of a precedent.

The Code of Ethics doesn't help much. You are enough of a realist to realize that it was designed primarily for maintaining the status quo of the cult of consultants and doesn't make much sense to the engineer in industry.

Looking for some sort of a model for your future activities, you think about the other professional engineers in your organization. Actually, if yours is a typical organization, the ratio of professional engineers to nonprofessionals will be about one professional engineer for every 50 nonprofessionals. Most of these will be department and section heads and most of these got in under the grand-daddy clause when the registration laws were originally set up.

Of course you have been given a lot of well-intentioned but misguided advice about emulating the professional manner, attitude and conduct of the medical doctor. You realize that most of this talk is ridiculous and stems not from a desire for

Circle 6 on Reader-Service Card for more information



parallel responsibilities but rather from a desire for a parallel social-economic status.

In this respect I might quote the head of the Department of Mechanical Engineering of one of the large eastern universities. "All this talk about doctors and engineers is ridiculous, I say an engineer should be treated with the same courtesy and consideration as a punch press operator, that is, responsibility, status and remuneration awarded in proportion to training, experience and ability. If they're seeking doctor status, let them earn a Ph.D." Ironically enough, this philosophy in action would probably result in a considerable improvement in circumstances for most engineers.

After considering all aspects of the situation, you finally come to the conclusion that professional licensing, instead of entitling you to special consideration, places greater demands on you for professional excellence in the future.

SELECT MINORITY GROUP

The increased demand for excellence required by registration within the profession will be rewarded by a complete lack of recognition outside the profession—at least for the immediate future. Most people won't know or care what a professional engineer is.

Even the personnel department may be ignorant of the implications and will have made no provisions for registration in setting up the engineering job classifications. In fact, if there is a technical and clerical union operating within your company, you may be even stripped of the individual bargaining rights which go with professional status.

THE FUTURE OF PROFESSIONAL ENGINEERING

The future of professional engineering actually lies in your own hands and in those of your fellow registrants. Your continuing and growing excellence will attract more engineers to the fold and a larger and larger group will eventually achieve professional and public recognition.

By all means, have your license framed and hung in a conspicuous place near your desk. This can have a powerful influence on your unregistered associates, especially if you are fairly young.

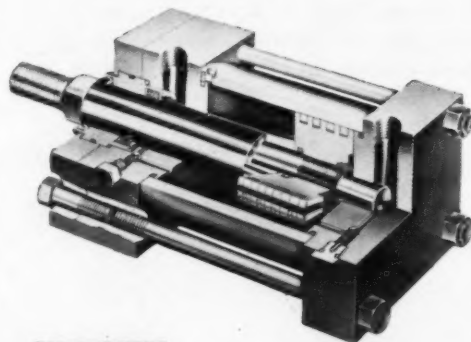
Above all, join the local chapter of an organization for professional engineers. Most of these are still very much oriented to the engineer in private practice. However, all of them contain a growing faction of engineers in industry and this faction will appreciate your support.

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Tapered cushion piston provides gradual, shock-free deceleration. No need for cushion adjusting screws.

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HYDRAULIC POWER

Circle 7 on Reader-Service Card for more information

MANIFOLD DEFLECTS WATER TO STEER AND REVERSE JET BOAT

Water discharges through a nozzle located in the stern to propel a boat through the water. The jet thrust unit is a mixed-flow pump driven by a conventional marine internal-combustion engine.

Water enters a single-stage, mixed-flow pump through the intake port in the hull bottom. It is discharged at high velocity through the steering deflector on the transom.

Utilizing Newton's Third Law, the water jet exhausts into the air to achieve the pressure differential necessary to create the high jet velocity required.

In the conventional boat with inboard engine arrangement, and with the rudder placed behind the propeller, steering at low forward speeds is ineffective, and steering in reverse is almost totally controlled by the propeller torque, causing the boat to veer constantly to one side.

The jet-propelled boat, with thrust-directed steering, is controllable at all forward speeds, from circling in less than its own length at idle speeds, to making a 180-deg turn in slightly greater than its own length at full speed. This latter maneuver is not recommended, since the inertia of the boat tends to drive the stern under and it can be a wet experience for the occupants.

A carefully shaped inlet duct minimizes friction losses in the jet thrust pump. The impeller vanes and the diffuser vanes are developed to avoid shock losses and friction losses. The nozzle is shaped to accelerate the water uniformly, thus realizing maximum efficiency and flow rate for the available pressure.

The propelling force originates with the pressure generated by the pump impeller. This item forces water through the nozzle continuously at a high velocity (V). This jet velocity (V) is equal to the pump flow rate (Q) divided by the nozzle area (A). The reaction force, or thrust (T), is proportional to (QV), and the power (P) required to develop this

thrust is proportional to (QV^2).

By substitution, the expression for power may be written as $P = TV$.

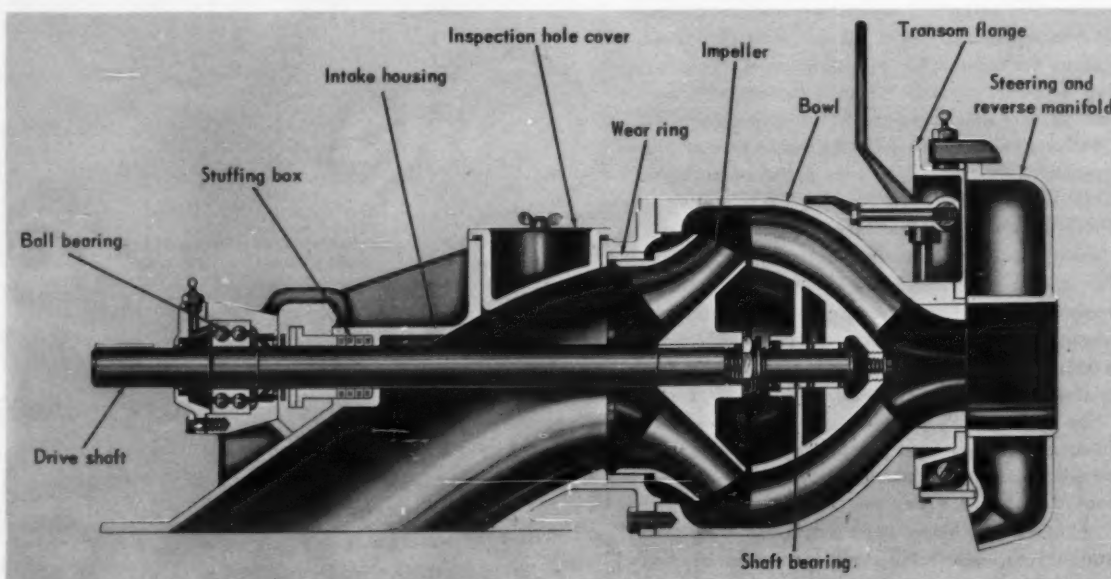
This later expression suggests the selection of a high specific speed axial-flow pump, which must be multistaged to achieve the high jet velocities for high boat speeds.

Though the approach is proper, two additional criteria for good application are necessary: boat-velocity to jet-velocity ratio (V_b/V_j) and pump efficiency. The limiting value of V_b/V_j is 1.0 for the condition when the boat velocity is equal to the jet velocity; above this ratio the pump is no longer add-

ing momentum to the water and the shaft work is zero. The boat velocity therefore always must be less than the jet velocity.

The maximum speed that can be attained by a jet-propelled boat will be reached when the drag developed by the hull equals the thrust developed by the jet unit. The drag characteristic of a hull depends on hull shape, skin friction, projected area, displacement and weight distribution, and the drag will vary with boat speed. As any of these values increases, the drag increases and the top speed of the boat decreases.

A lightweight hull with a flat or moderate V -



JET-DRIVE BOAT manipulates shallow bottoms easily because there is no propeller or rudder protrusion below hull. In commercial application, fishermen's nets and floating de-

bris are not exposed to propellers. Efficiencies of 10 percent better than equivalent propeller-driven inboard boats are claimed for jet-propelled boats.



Edward W. Schrader, Western Editor

bottom will tend to plane, or lift out of the water, above a critical speed. Boats of this design constitute a majority of the small pleasure craft being produced at this time.

One test on a moderate V-bottom boat, 15-ft hull, weighing 150 lb loaded and driven by 125-hp engine, developed 1100-lb thrust and accelerated the boat to a top speed of 45 mph with a jet velocity of 65 mph. For this case, the V_b/V_j ratio is 0.7, which is considered good.

The second criteria to be considered is pump efficiency. The pump should operate near its peak efficiency point, and be coupled directly to the engine, so it will operate at the best engine speed.

Specific speed is defined by the equation

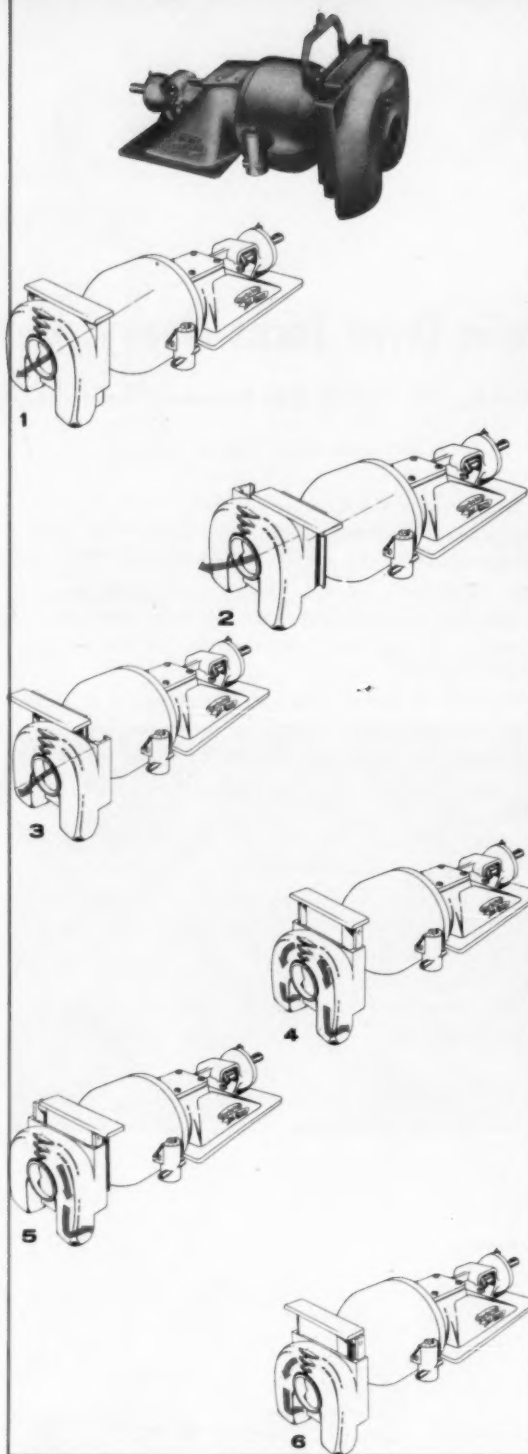
$$N_s = \frac{\text{RPM gpm}}{H^{3/4}}$$

where H is pressure head in feet of water. Experimental results show the highest efficiency is achieved for the radial impeller design, which discharges at 90 deg to the shaft axis. For this type, highest efficiency occurs in specific speed range from 250 to 5000. The mixed-flow impeller, which discharges at an angle to the shaft axis that is less than 90 deg and is greater than zero deg, is best in the specific speed range of 5000 to 9000. The axial impeller, or propeller, operates well in the specific speed range of 7500 to 14,000.

From consideration of specific speed, the high-speed, medium-thrust boats which require high pump pressure for high jet velocity and low or medium flow, should have a jet-propulsion pump unit with a low or medium specific speed value. The centrifugal pump should be fitted with a radial or mixed-flow impeller, depending upon the actual value of N_s .

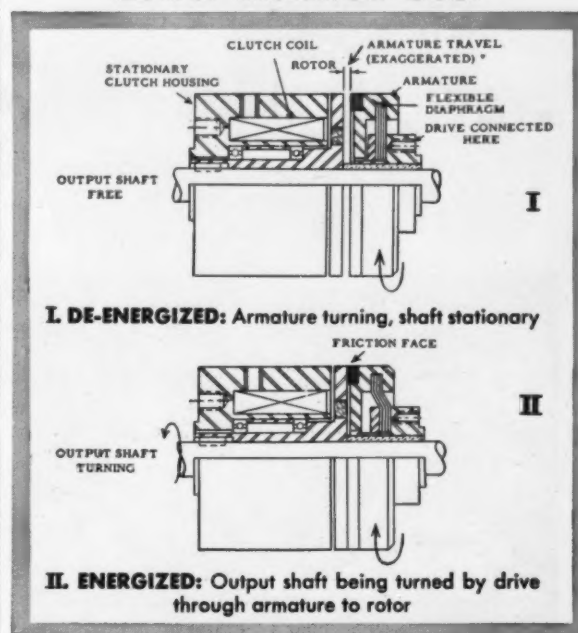
Boats requiring high thrust with low jet velocity will require a high specific speed pump and use an extreme mixed-flow impeller, approaching a propeller in shape or actually using a propeller.

The single-stage centrifugal pump propulsion unit has been selected for the jet drive because the smaller package fits in the limited hull space. The steering deflector is a design development of the Berkeley Pump Co., Berkeley, Calif.



1. STEERING MANIFOLD for straight ahead position.
2. STEERING MANIFOLD shifted to left. Jet stream diverted to left, turning boat to left.
3. STEERING MANIFOLD shifted to right. Jet stream diverted to right, turning boat to right.
4. STEERING MANIFOLD shifted down. Water diverted equally into reverse ports, moving boat straight back.
5. STEERING MANIFOLD down and shifted to left. Water diverted into right reverse port for left turn in reverse.
6. STEERING MANIFOLD down and shifted to right. Water diverted into left reverse port for right turn in reverse.

Choose A Diaphragm Electric Clutch for Superior Performance Lower Installed Cost



Like most really sound engineering ideas the practicality and economy of electric clutches and brakes without the conventional sliding armature had to be proved in practice.

Now, a few short years after their introduction, Simplatrol electric clutches and brakes have proved that their design, based on a flexible diaphragm in the clutch's armature, does do a better job than armature plates sliding on splines, pins, or hubs.

Simplatrol's armature, a one-piece assembly, deflects to perform clutching or braking action. Wear is reduced to vanishing point since there are no sliding parts to contact each other; instant performance is achieved without slow release, or "hanging up."

This Simplatrol diaphragm principle ensures smoothness, quietness, and consistency.

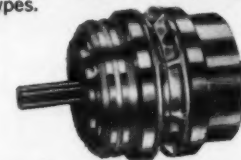
Compare the installed cost.

Simplicity carries through to the installation, reducing cost here as well. You simply slip one of the 2 or 3 major assemblies onto the shaft — that's all the assembling you do! No pins, no nuts, no washers, no springs to run up labor cost.

Machined parts in the clutches and brakes are of uniform quality. There's close built-in control of tolerances and finishes . . . and the assemblies are pre-burnished! All clutches include bearings, machined surfaces and bolt holes for direct mounting of your drive unit.

Simplatrol offers a complete range of diaphragm electric clutches from torque of 10 ounce inches to 470 pound feet in diameters from 3/8" to 12 1/2". Styles include clutches, brakes, clutch-brakes, duplex clutches, and couplings in both rotary and fixed field types.

Ask Simplatrol's sales engineers to demonstrate to you specifically how the unique advantages of flexible diaphragm performance will benefit your operation.



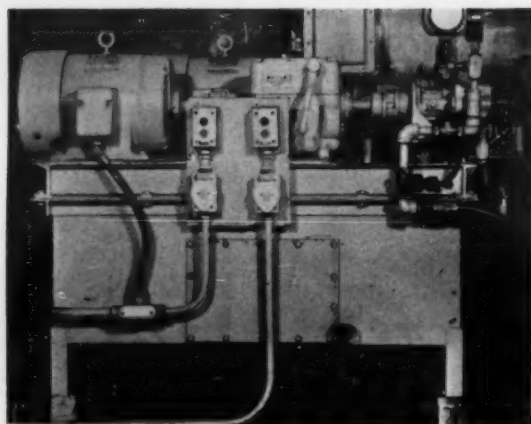
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Representation in Key Industrial Areas

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Low-Speed Hydraulic Drive Turns Heavy, Unbalanced Drums

1500-PSI System Turns 350,000-Lb, 16-1/2-Ft-Dia Drum against 60,000-Lb Tangential Thrust Load

Lars G. Soderholm, Midwest Editor



HYDRAULIC POWER UNIT provides eight speeds of rotation. Used with 7-inch-dia by 20-inch stroke cylinder, high speed of 15 minutes per revolution or low speed of 1 hr 41 minutes per revolution can be set.

A hydraulic-powered drive, developed for rotating drums carrying heavy unbalanced loads, uses a hydraulic ram that acts against a circular rack. A multi-stage hold-back device, designed for the special wedge-shaped teeth on the circular rack, limits drum slip-back during the return stroke of the single-cylinder system.

In order to secure slow-speed rotation of a heavy drum, conventional design methods call for two important considerations. One is the speed reduction necessary from the original power source. The other is providing sufficient strength in the drive mechanism to withstand the thrust load imposed as material in the drum builds up on its rising side. Both chain and sprocket drives and rack and pinion drives were considered before the development of this system, but were discarded because of physical incapacities or economic impracticabilities.

This drum drive uses a circular rack, flame-cut and welded in segments for low cost. For strength,

the rack uses a special wedge-shaped tooth with a steep driving side and shallow backside.

The rack, located about the outside diameter of the drum, is engaged by a hydraulic ram using a special yoke connection with pivot pins riding in grooves along the side of the rack. A trailing link thrust bar is used to engage the rack teeth.

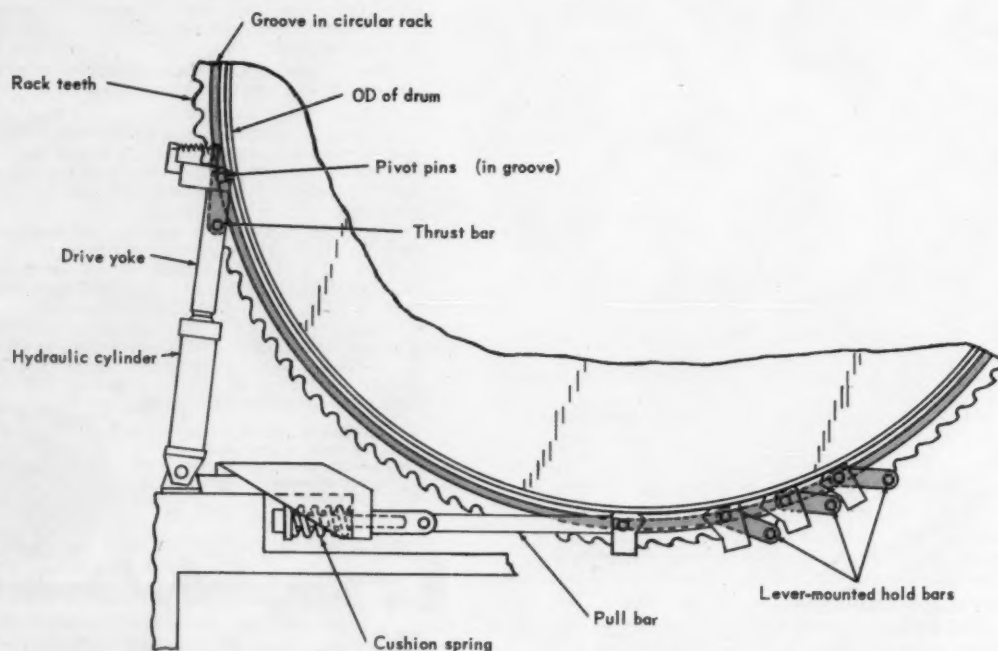
With the single-cylinder drive system, a multiple-stage hold-back mechanism is spaced about the drum. It limits drum slip to a fraction of a tooth length depending on the number of locking links used.

With one hydraulic cylinder providing the turning force on the drum, an intermittent motion is obtained as the hold-back mechanism stops the drum during the power cylinder's return stroke. With two cylinders, however, one cylinder is in operation during the time the other is retracting, and continuous rotary motion may be obtained.

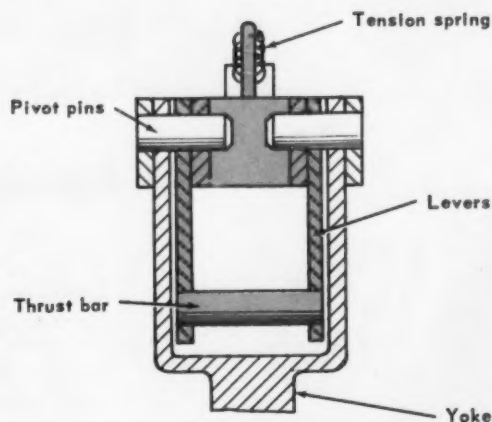
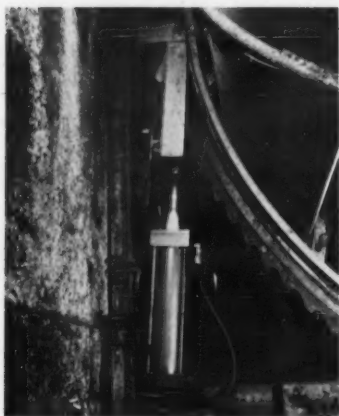
Advantages of the hydraulic drum drive are its low initial cost compared with conventional alternate methods and its extreme ruggedness. The special tooth profile provides several times as much metal at the stress area as a spur gear tooth provides. Also, since the sliding action of spur gear teeth has been eliminated, wear is negligible and lubrication is not critical.

Another advantage is in the small space requirements needed for mounting the hydraulic ram and the hold-back unit. The hydraulic pumps, valves and other controls can be consolidated in a power package that can be placed in any location remote from the drum itself.

The patented hydraulic drum drive was conceived by A. R. Graff, Columbia Malting Co., Chicago, Ill.

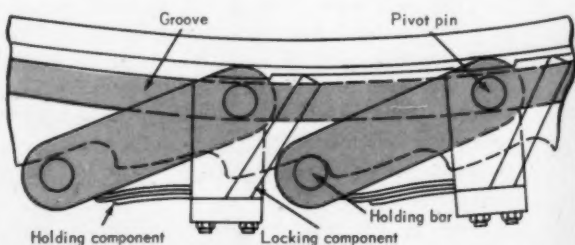


HYDRAULIC DRUM DRIVE consists of hydraulic power cylinder (either single- or double-acting) with special drive yoke that engages teeth of circular rack fastened about OD of drum. After pivoted power cylinder has advanced rack tooth one stroke length, series of three spring-loaded hold bars limits drum slip-back during cylinder's return stroke to 1/3 tooth or less. Cushioning during engagement of hold bar is provided by compression spring at end of pull bar on holding mechanism.



DRIVE YOKE, located at end of pivoted cylinder, consists of two arms with pins that ride in grooves beside circular rack. Trailing lever arms suspended from pivot pins hold thrust bar that engages drive side of drum rack tooth. Mechan-

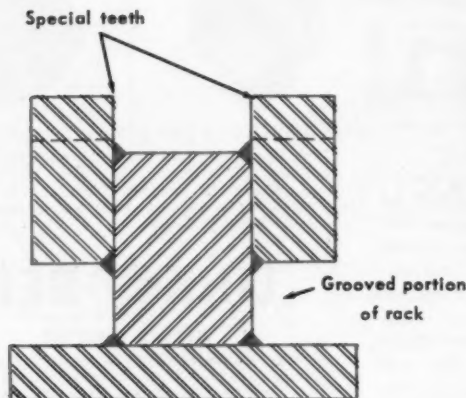
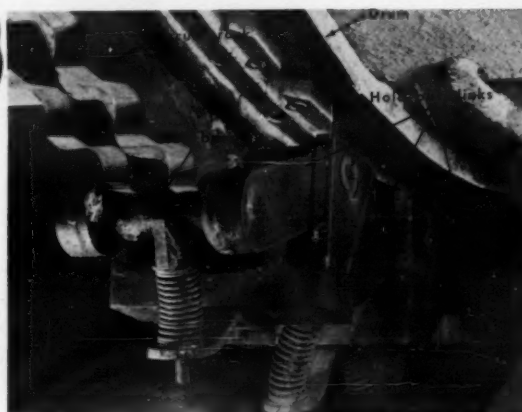
ical design of trailing thrust bar permits use of relatively light components and enables small spring to hold thrust bar in place against driving tooth and still allow overriding during cylinder's backstroke.



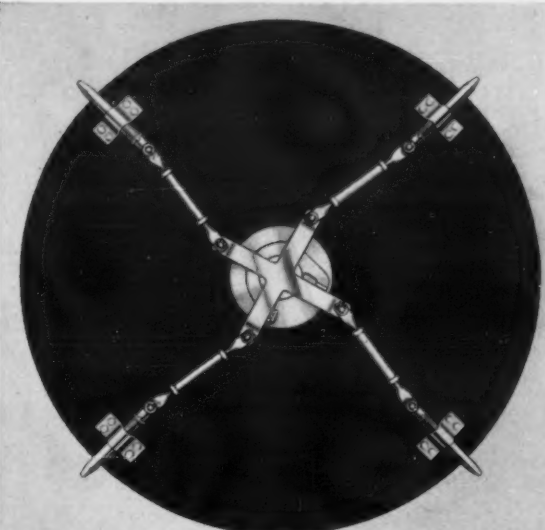
DRUM HOLD-BACK MECHANISM consists of three hold bars, each at end of lever arm whose pivot point rides inside grooves of circular rack. Light springs allow hold bars to slide past back sides of teeth during power stroke. When drum begins slip-back, nearest hold bar slips into root of tooth and, because of lever arrangement (rather than springs), has force components directed downward, gripping tooth tighter as load increases.



CIRCULAR RACK uses flame-cut tooth sections welded to rolled bar lengths. Rather loose tolerances can be tolerated as well as some degree of out-of-roundness. Illustrated teeth are 5 inches face-to-face and each side is approximately 1-1/2 inches wide. No finishing operation is used after welding.



FABRICATION OF CIRCULAR RACK



ADAMS RITE PANEL BOLTING SYSTEMS

STANDARDS OR SPECIALS PROVIDE POSITIVE SEAL FOR DOORS AND HATCHES

ADAMS RITE designs and manufactures multiple-point door bolting systems to virtually any size or configuration. Standard 2 and 3 point **Tight Seal Door Bolting Systems** are available, off the shelf, for positive closure of a wide variety of panels. Both standard and special AR systems are in use on such diverse applications as electronic equipment, environmental chambers, utility trucks, aircraft and missile ground support units and paint spray booths. Basic material may be aluminum, steel or corrosion-resistant steel. In addition to bolting systems, AR manufactures a line of locks, latches, tie-down fittings and mechanical motion control devices. To assure the right hardware for your design package, contact ADAMS RITE.

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FLEXIBLE COUPLINGS

**fight
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**tooth
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The high hardness of chain rollers and sprocket teeth gives Link-Belt "RC" flexible couplings the stamina to withstand shock loads, reversing loads and any pulsating load in normal service. Long life is assured on both low- and high-speed operations. This durability plus remarkable simplicity of design—easy installation—adds up to important savings of both time and money. Want to measure the savings in terms of your own application? Contact your nearest Link-Belt office listed under COUPLINGS in the classified section of your telephone directory. Ask for Folder 2363.



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To help you get greater coupling life, Link-Belt offers two types of housings. Both are designed to facilitate lubrication, retain lubricant and protect the coupling from dust or moisture. Type R—spun metal, vertical split. Type P—molded plastic, horizontal split.

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FLEXIBLE COUPLINGS

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IDEAS...MECHANICAL

Agitator Keeps 60-Percent

Lars G. Soderholm, Midwest Editor

A centrifugal pump using a top inlet and two downward-facing discharge nozzles is used to agitate heavy concentrations of solid sodium silicofluoride and to maintain a mixture of uniform density. This inlet and nozzle configuration also permits the agitator unit to be lowered into a settled tank and to develop full pressure immediately to bring the materials back into suspension.

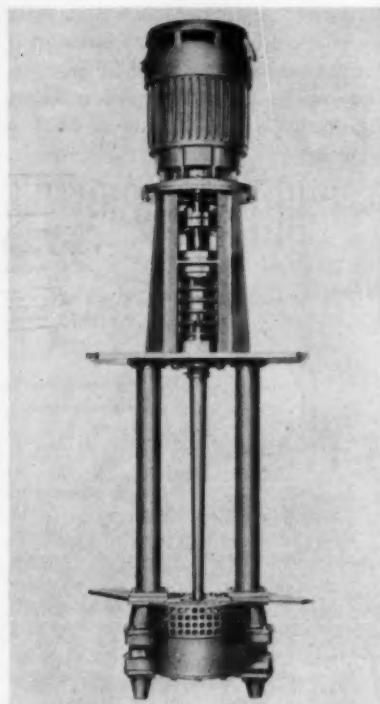
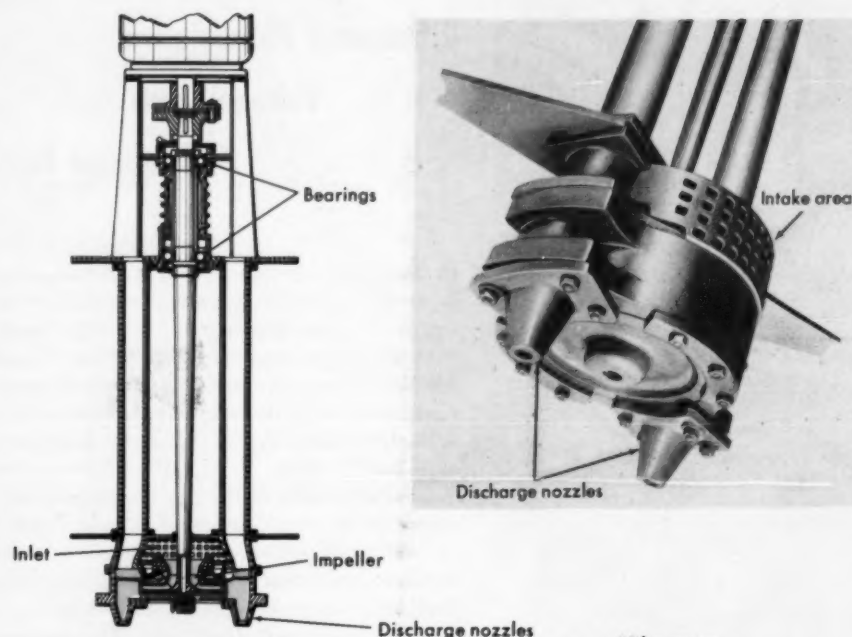
In seeking a more economical way to fluoridate the water supply, engineers in the City of Chicago's south side filtration plant began experimenting with solid sodium silicofluoride as an additive rather than the conventional liquid hydrofluorsilic acid. It was shown that the high concentrations in the order of 60 percent solids were the most practical to handle because lower concentrations tended to pack upon settling and resuspension was more difficult.

Prior to use, the sodium silicofluoride and water mixture is held in 5-1/2-ft-dia by 8-ft-high day tanks. A 3-inch jet flow agitator powered by a 15-hp motor keeps the mixture in suspension. The normal rate of withdrawal is about 2 gal per hr so one tank can be used for nearly a week. The agitator assembly is positioned by internal guide rails and can be raised or lowered into or out of the tank. When raised from the tank, the agitator drains completely through the discharge nozzles. When lowered into a settled tank, the clear liquid at the top of the tank is picked up first and the pump can develop full nozzle pressure immediately to agitate the contents. The unit is balanced hydraulically to compensate for impeller torque.

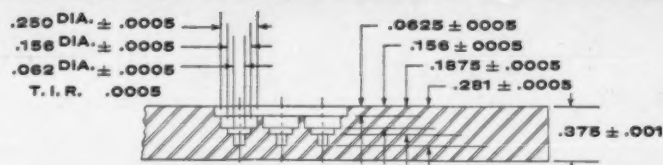
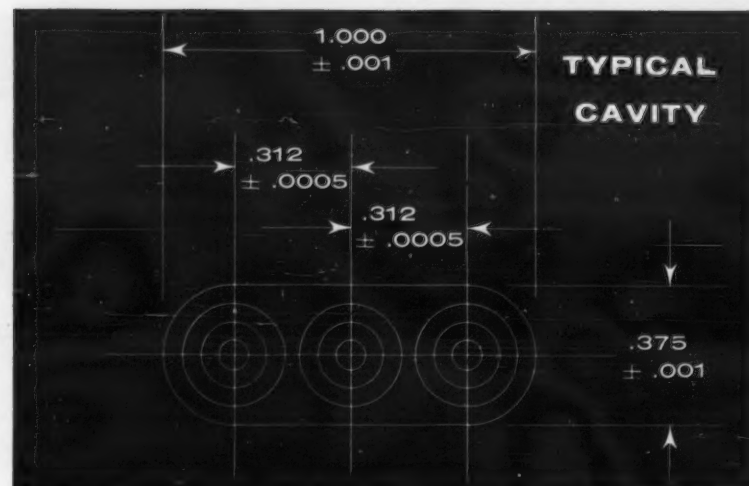
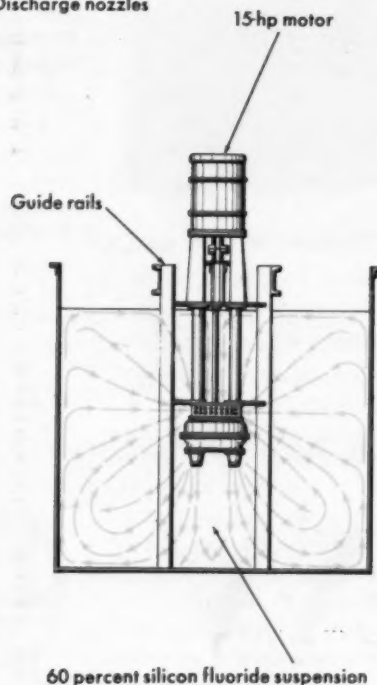
The Chicago Water Dept. will receive the solid sodium silicofluoride material in carload lots which will be dumped upon arrival to a main 16,000 gal slurry tank. The material is very fine—95 percent being minus 300 mesh size. From the main slurry tank the suspended material will be pumped to the individual day tanks for metering into the water lines. Anticipated savings are expected to pay for the system in one year's time.

The Hazleton Type "VN" jet flow agitator is made by Barrett, Haentjens & Co., Hazleton, Pa.

Solid Fluoride Slurry in Suspension



JET FLOW AGITATOR uses top inlet construction with two discharge nozzles directed downward into tank. Sealed bearing units use two bearings each with individual grease reservoirs. No submerged bearing is used.



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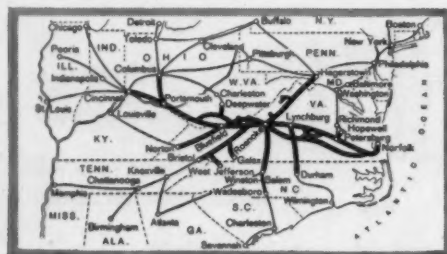
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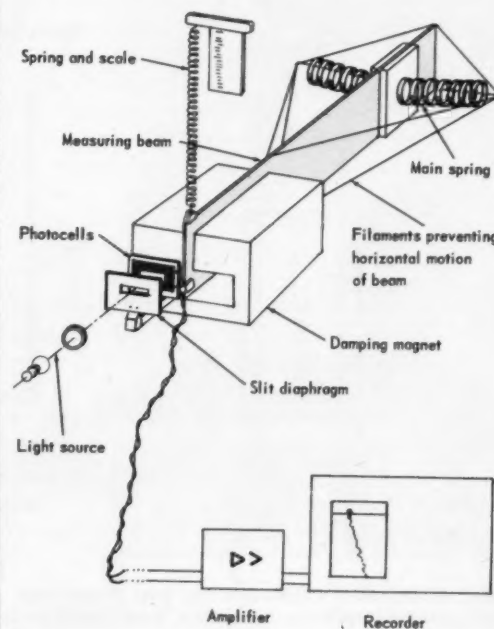
IDEAS... MECHANICAL

Differential Photoelectric
Voltage Yields
Gravitational Data

In a sea gravimeter, movement of the measuring beam affects the quantity of light incident on two photocells. The differential photoelectric voltage is amplified and recorded, yielding gravitational data. The gravimeter is mounted on a gyrostabilized platform to cope with accelerations up to 1 m/sec^2 , has accuracy of $\pm 2 \times 10^{-5} \text{ m/sec}^2$.

Key component of the instrument is a measuring beam in the shape of a long vertical strip. The strip is supported towards one end between horizontal torsion springs and constrained by eight very thin metal filaments to move in a vertical plane only. The opposite beam end carries a diaphragm which admits light from a lamp-and-lens combination to two photocells mounted one above the other.

The beam can be adjusted to a horizontal

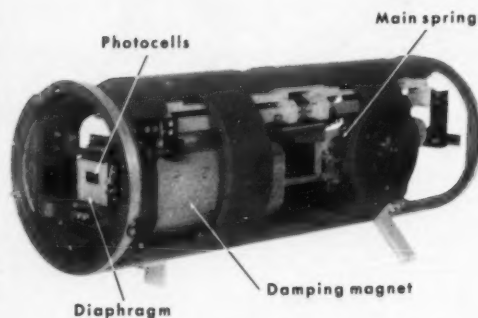


R. F. Stengel, German Editor

orientation by a spring attached to the rotating end. High-frequency beam motions are suppressed by a large damping magnet. Slow motion caused by changes in local gravity shift the diaphragm, admitting more light to one photocell and less to the other. The difference in output voltage is amplified and used to drive a strip recorder.

A change of 10^{-5} m/sec² in gravitational field strength causes a voltage change of the order of 10 μ v only. As conducting films of condensed sea water might cause creeping currents, all sensitive components are designed with integrally cast insulation. Inductive and thermoelectric voltages also are suppressed.

To compensate ship motions even in rough seas, the gravimeter is mounted on a gyro-stabilized platform. The supporting platform can be fully instrumented to obtain magnitude, direction and phase of accelerations for correction of leveling and cross-coupling effects. Gyro drift is detected by two high-inertia levels which do not follow ship motions and represent a true reference horizon. The sea gravimeter is produced by Askania-Werke, Berlin, Germany, a subsidiary of Continental Elektroindustrie AG.



MEASURING UNIT without light source.



In a test exposure to open flame, door seal made of HYPALON (left) extinguished itself as soon as fire was removed. Ordinary synthetic rubber seal continued to burn.

FLAME RESISTANCE

One more way HYPALON® helps assure maximum appliance reliability

Expose natural rubber to open flame and you've got a fire on your hands. Same is true of ordinary synthetics. But not HYPALON.

You build an important bonus of safety into appliances every time you specify DuPont HYPALON synthetic rubber for key resilient parts . . . *because HYPALON does not propagate flame.*

In fact, any way you look at it, HYPALON's unique combination of properties makes it the ideal elastomer for "service free" appliance design. Take ozone resistance: HYPALON is *immune* to ozone in any form; no other rubber is. Or durability: HYPALON's resistance to abrasion, flex-cracking and aging is outstanding. Or

chemical resistance: HYPALON's performance in contact with oils, greases, bleaches, detergents and other chemicals is exceptional. In addition, HYPALON parts can also be made in an assortment of stable, attractive colors (and white) to enhance styling and sales appeal.

Today, HYPALON is bettering performance for a variety of appliance components—including drain hose, bleach tubing, electrical wire, gaskets and seals. To learn how this versatile design material can help *you* assure maximum appliance reliability, write for our free booklet outlining properties and applications. E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department DN-12, Wilmington 98, Delaware.

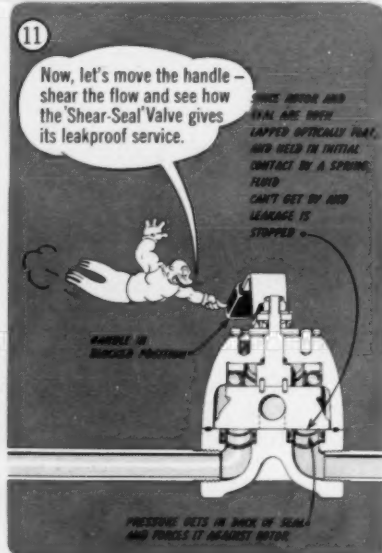
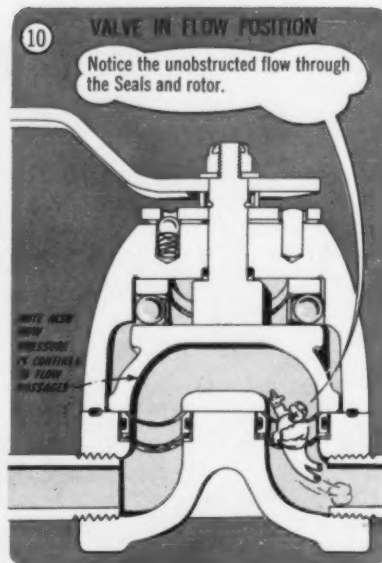
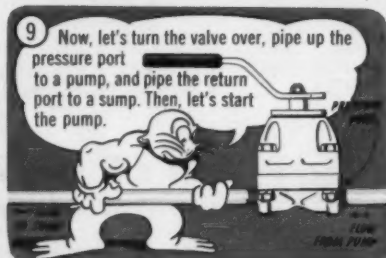
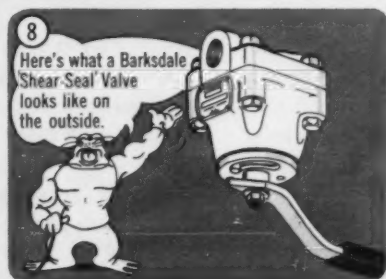
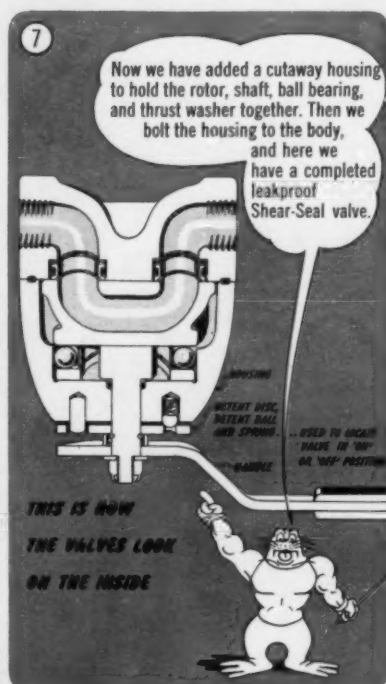
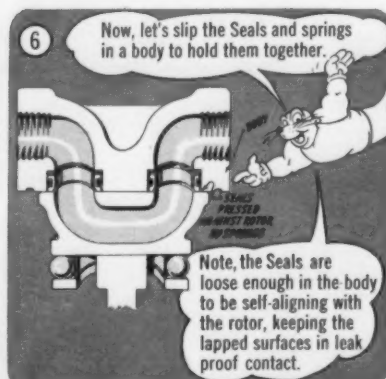
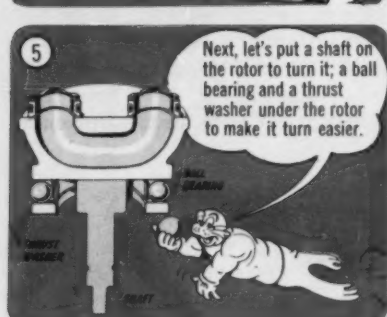
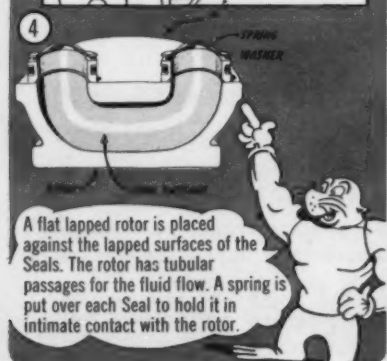
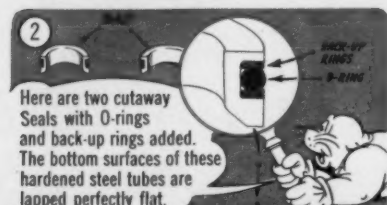
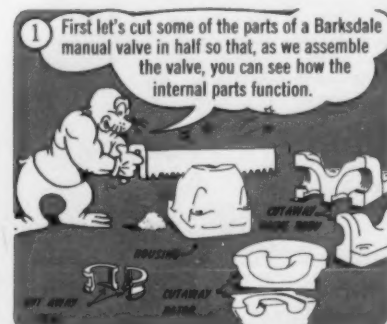


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The patented Shear-Seal principle

AS EXPLAINED BY...
SUPER SEAL



PATENTS

Flexible Coupling

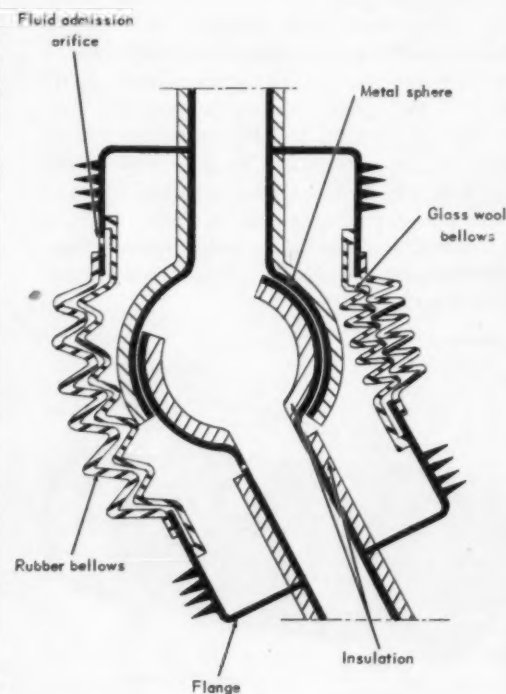
French Patent 1,244,446; Pierre Maurice, assigned to Soudure Autogene Francaise Co., Paris, France.

This coupling, intended for extremely high or low temperature use, consists of two elastic, closely machined metal spheres. Spheres are snapped together. Piping is thermally isolated by glass wool or similar material.

As pressure inside the coupling builds up, spheres are pressed together to provide a good seal. At a distance from the spheres, flanges are welded to the pipe to support rubber bellows, thermally protected by a glass wool bellows inside.

The coupling works with controlled leakage. Space between bellows and spheres is filled with the same fluid as is in the piping, but at higher pressure.

The sealing fluid leaks slowly through the coupling to the interior of the pipe. As an example, if liquid oxygen is being carried, gaseous oxygen at normal temperature is fed to the protective space, at a higher pressure. This design allows the use of rubber bellows and provides good sealing and small overall thermal losses.



CONTROL VALVE DIVISION
Barksdale valves
5125 ALCOA AVENUE • LOS ANGELES 58 • CALIFORNIA

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The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

ROTARY RADIAL PISTON ENGINE

U S Patent 3,003,308; Leslie W. Beaven, 44 E. Washington St., Palatine, Ill.

FLUID-COUPLED TRANSMISSION MECHANISM

U S Patent 3,003,318; Don Heyer, 4169 Cogswell Rd., El Monte, Calif.

HYDRAULIC ACTUATING SYSTEM

U S Patent 3,003,319; Jerry H. Gordley, Brookville, Ohio, assignor to General Motors Corp., Detroit, Mich.

LUBRICATION MEANS FOR SEALED COUPLINGS

U S Patent 3,003,338; Backman Wong, Baltimore, Md., assignor to Koppers Co., Inc.

RUBBER TORSIONAL UNIT

U S Patent 3,003,339; Fred L. Haushalter, 2185 Scott Lake Rd., Pontiac, Mich.

HYDRAULIC TIMING DEVICE

U S Patent 3,003,341; Richard C. Aland, Highland Park, Mich., assignor to Continental Motors Corp., Muskegon, Mich.

BALL-BEARING SCREW AND NUT ASSEMBLY

U S Patent 3,003,361; Ernest D. Boutwell, 306 Webber St., Saginaw, Mich.

MOTION-TRANSMITTING DEVICE

U S Patent 3,003,362; Jack E. Martens, Gary, Ind., assignor to The Anderson Co.

PUMP WITH PRESSURE-LOADED BUSHINGS

U S Patent 3,003,425; Charles E. Flowers, Dayton, Ohio, assignor to General Motors Corp., Detroit, Mich.

HYDRAULIC CONTROL SYSTEM WITH FLOW-RESTRICTING MEANS

U S Patent 3,003,474; Walter B. Giles, Schenectady, and Robert A. Aiken, Scotia, N.Y., assignors to General Electric Co.

ANTISKID DEVICE

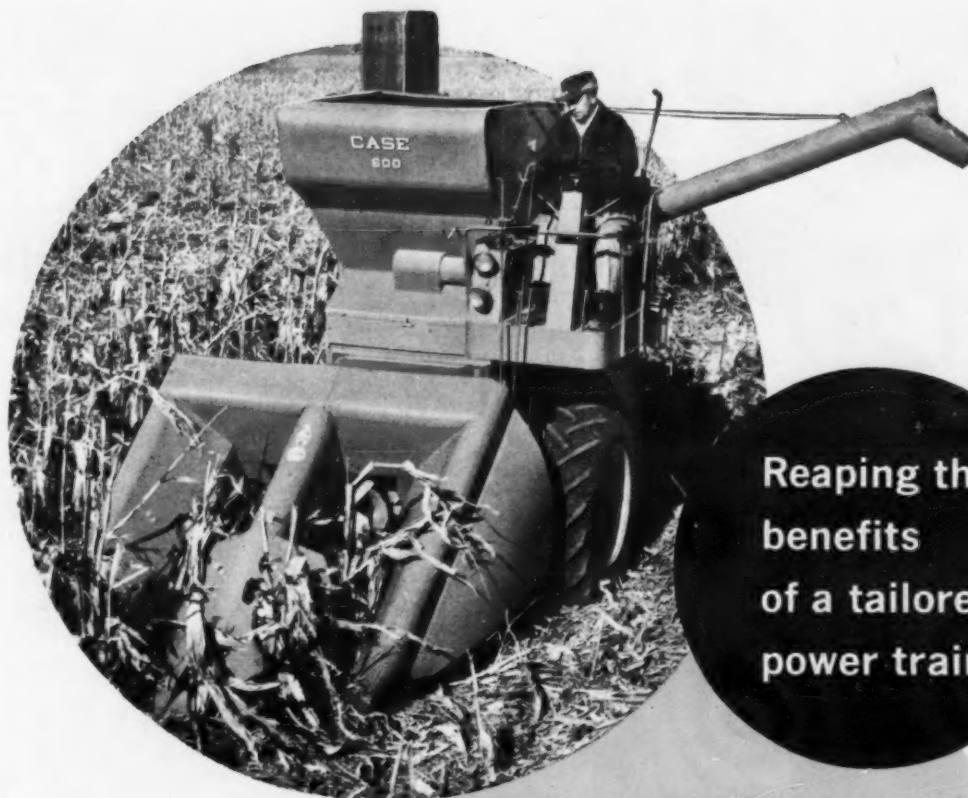
U S Patent 3,003,824; Lucien Peras, Billancourt, France, assignor to Regie Nationale des Usines Renault, Billancourt, France.

TUBULAR-TYPE ANTIFRICTION BEARING ASSEMBLIES

U S Patent 3,003,830; William J. Blazek, New Lexington, and James J. Strnad, Bedford, Ohio, assignors to Lemco Products, Inc., Bedford, Ohio.

FLUID COMPRESSOR

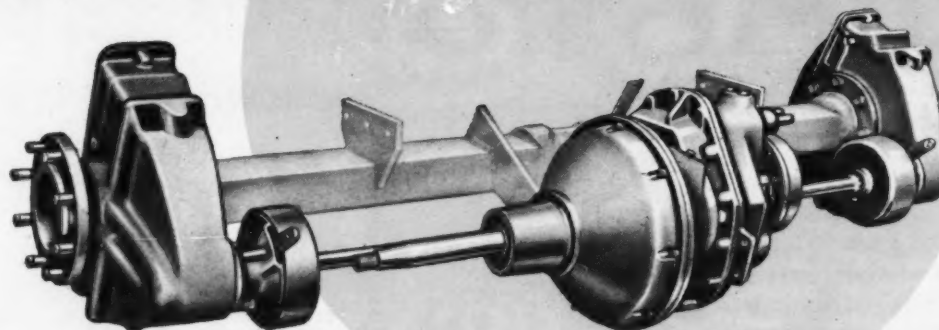
U S Patent 3,003,837; Frank E. La Flame and Frank L. Rifner, Dayton, Ohio, assignors to General Motors Corp., Detroit, Mich.



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Custom Drive Helps New Case "600" Combine Do Its Chores!



J. I. Case Company engineers designed the new "600" Combine with three significant advantages—big capacity, extra maneuverability and unexcelled versatility! More than ever, here is a combine engineered and built to do a remarkable job of meeting the needs of all crops and harvesting conditions.

To make sure this equipment does all its jobs well, a custom-made drive was needed. And because of their proven performance on other J. I. Case vehicle needs, Rockwell-Standard engineers were called in to work with Case planners and designers. Result of this cooperative effort was the new Rockwell-Standard TA-251 Axle. In every test to date, this specially designed driving axle has proven that it will give long, efficient, pro-

ductive service—and take all the rugged usage for which the Case "600" was built.

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Transmission and Axle Division, Detroit 32, Michigan

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DESIGN
DESIGN IDEAS
NEWS

ELECTRICAL

Magnetic Trip Latch Acts as Low-Energy Trigger

Lars G. Soderholm, Midwest Editor

A magnetic trip latch uses a d-c trip coil to counteract the force of a permanent magnet that holds a spring-loaded armature and trip rod in its cocked position. This permits a high-speed interruption of the circuit as the trip rod triggers the spring release that opens the recloser.

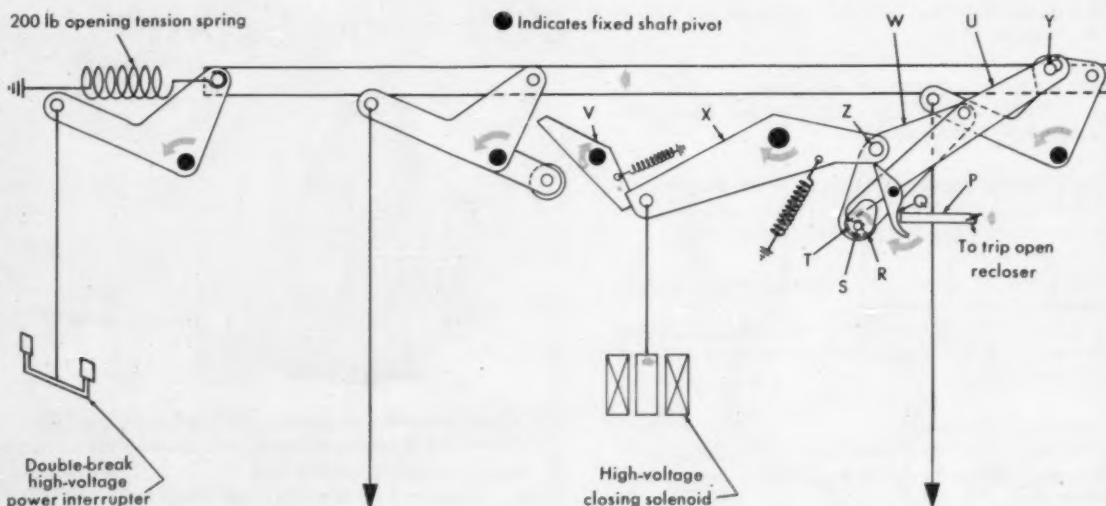
The design problem was to release the stored energy of the springs (loaded to 200-lb tension) quickly and using very low energy. Low energy was necessary because the unit is tripped via a static electronic control powered by a self-contained battery.

This was done by using a magnetic trip latch in which the power needed to trip the main latch is provided by a spring acting on the trip rod. The spring is opposed by permanent magnetic attraction between the armature (on the trip rod) and

the core. The force of magnet is over 200 percent of the net pull exerted by the spring.

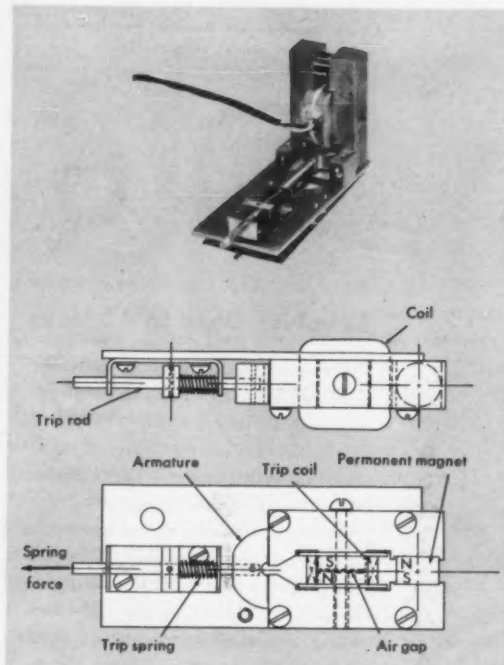
The trip latch is located inside the recloser and is free of influence from fields created by fault currents which flow through the high-voltage circuit inside the recloser. When a signal is received by the d-c coil in the magnetic trip latch, response is from 1/2 to 3/4 cycle from time of energization to main latch release. The coil operates nominally on 12w power, although it will operate down to 2w. A d-c solenoid, if used to do the same work in the same time, would require almost three times the power input.

The magnetic trip latch was developed by Line Material Industries of the McGraw-Edison Co., Milwaukee, Wis., for use on their line of electronically controlled oil circuit reclosers.

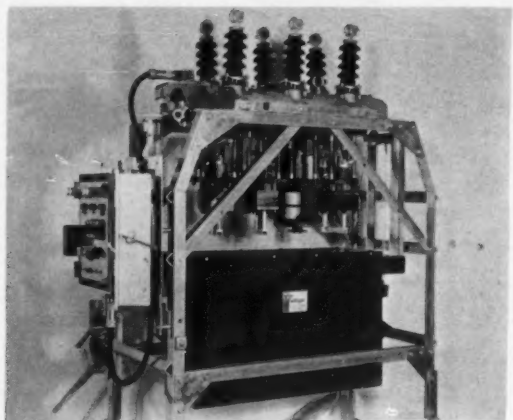
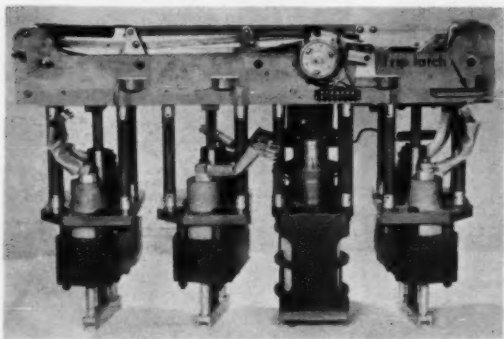


RECLOSER MECHANISM consists of bar under load by tension spring, restrained by toggle linkage. All three bellcranks are in "contact closed" position. Toggle acts as rigid connection between point Z and pin Y. Point Z, which joins links X and W, is fixed since X is restrained by latch lever V. Links U and W are rigid under compressive force between Y and Z since bar U is restrained by half-moon latch T that pivots about S. When magnetic latch releases, trip rod P rotates lever Q clockwise, which in turn rotates cam-like lever R counterclockwise. Half-moon shape T also rotates counterclockwise since it is attached to R. This re-

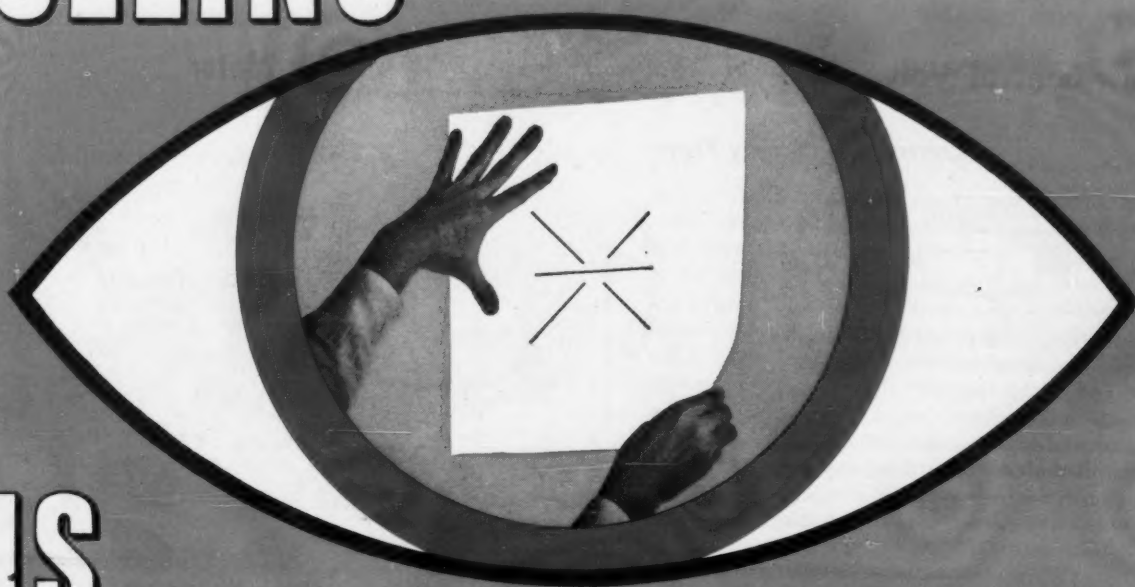
leases tip of lever U which collapses toggle formed by links U and W. As bar moves left, pulled by tension spring, bellcranks move counterclockwise, opening contacts. As center bellcrank turns, it engages latch V which rotates clockwise, releasing link X. Spring causes X to rotate clockwise, which withdraws plunger from high-voltage closing solenoid and also extends and remakes toggle between Z and Y. When high-voltage solenoid is energized, X is rotated counterclockwise. Rigid V-W toggle causes bellcranks to rotate clockwise, re-extending opening springs, after which latch V drops back in place.



MAGNETIC TRIP LATCH consists of spring-loaded trip rod held in cocked position by permanent magnet acting against armature located at rear of trip rod. When d-c coil is energized, flux is diverted from armature to air gap, allowing compressed spring to move trip rod to left, tripping recloser.



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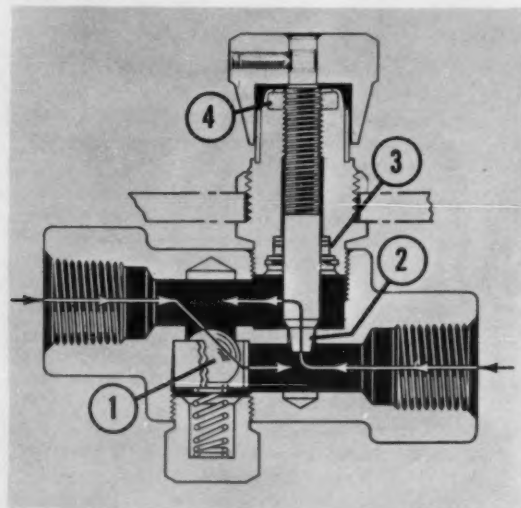
Circle 17 on Reader-Service Card for more information

Flow-Control Valve

301

Controls Two-Way Flow

This control valve allows unobstructed flow in one direction and precisely controlled flow in the opposite direction. A spring-loaded ball (1) serves as a check valve, allowing unobstructed flow from left to right while (2) is a needle valve which provides a wide range of adjustments in the opposite or controlled direction. A pressure gland is located at the port end of the housing (3) to seal off the needle threads of the upper housing, eliminating a trap for oil, air or dirt. Knob and dial models incorporate a nylon friction ring (4) which locks the needle at any

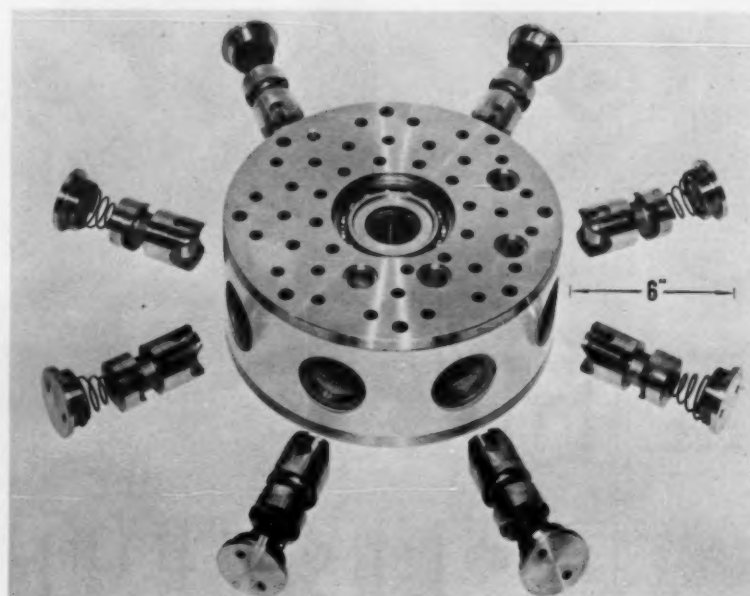


setting, preventing drift from a preset position. Valve bodies are steel or stainless-steel forgings designed to operate at 5000-psi oil or air pressures with a 5:1 safety factor. Three models of the valve are available: standard, which is mounted in the line; knob and dial, and knob and dial for panel-mounting. Three types of port threads are offered: 1-inch tapered, equivalent MS and AND tube sizes.

Auto-Ponents, Inc., 3001 Grant St., Bellwood, Ill.

Radial-Piston Hydraulic Motor

302



Cincinnati Milling Machine Co., Cimtrol Div., Cincinnati 9, Ohio.

Revolves Once in 42 Days

Servo control of this eight-cylinder hydraulic motor is said to allow speeds as low as 1/60,000 rpm. This works out to one revolution in 1000 hr, or a little under 42 days. The motor operates at a maximum recommended pressure of 500 psi and is capable of speeds as great as 500 rpm for short intervals. At full capacity, the motor's theoretical torque is 3.52 lb-in per psi. Operating alone, the motor has a frequency response up to 250 cps. The eight cylinders are divided into two sets of four, allowing operation of the hydraulic motor with either series or parallel connections. When parallel connected, the motor requires 22 cu in per revolution; in series, 11 cu in per revolution.

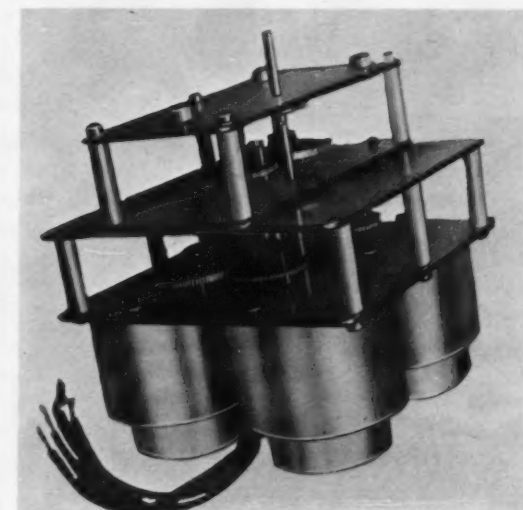
Multispeed Chart Drive

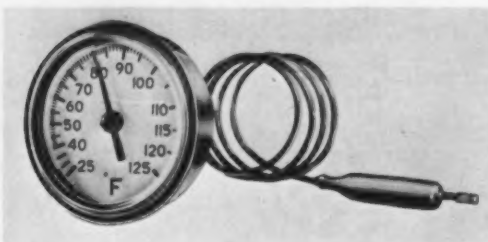
303

Uses Electric Switching Only

Up to 40 different output speeds on a single shaft, with rotation in either direction, are possible using electrical switching only. The unit consists of four reversible motors coupled to the output shaft through three differentials. The individual reversible motors provide rotation of the output in multiples of 1, 3, 9 and 27. For example, the speed of 40 consists of 27 plus 9 plus 3 plus 1 while a speed of 4 is 3 plus 1. A speed of 6 is obtained by using 9 minus 3. By using appropriate gear trains, speeds from 1/2 revolution per day to as high as 200 rpm may be obtained.

Bristol Motors Div. of Vocaline Co. of America, Old Saybrook, Conn.





A multiturn spiral bourdon coil is the sensing element of this remote-reading thermometer. The coil, capillary tube and bulb are filled with a volatile liquid or gas to provide positive actuating forces. The elimination of gears, bearings and linkages is said to allow a long, trouble-free service life. As many as 17 different scales are available, ranging from -40 to 60F, up to and including 100 to 350F. The thermometer is offered with copper, plain, plated or braided capillary tubes of specified length as well as in four different mountings for various applications. Calibration accuracy is nominally 3 percent of scale span. Special ranges, dial arcs or dial printing can be supplied on request.

American-Standard, Controls Div., 5900 Trumbull Ave., Detroit 8, Mich.

Low-Pressure Indicator

305



Sensitivity normally found in much larger units is achieved in this low-pressure indicator with an especially designed noncorrosive sensing diaphragm. Operating range is from 0 to 40 inches of water with an accuracy and repeatability of ± 1 inch of water. The device shows a hysteresis of 0.5 inch of water from -65 to 185F. Diameter is 2 inches, length is 3.9 inches and the unit conforms to shock and vibration resistance requirements of MIL-E-5272C. The Model 8007 low-pressure gage is intended for application in ground-support and flight equipment and many commercial installations.

Aero Mechanism, Inc., 7750 Burnet Ave., Van Nuys, Calif.

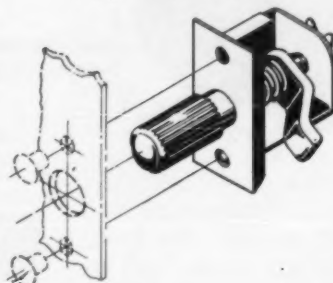
how will you fasten that panel?

It's a good design, but

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56 pages of standard fasteners in our new Handbook No. 11 Send for one... it's free. Write Southco, 232 Industrial Highway, Lester, Pa.*

Adjustable Fastener



Best Application: To compress a gasket, resist vibration, fit varying frame thicknesses.

Form: One piece latch installed by passing knob through door. Quarter turn opens or closes. No striker required.

Features: Further turning of knob changes grip to hold different frame thicknesses, tightens door against gasket.

Availability: From stock in 4 sizes, miniature to large. *Handbook pp. 28-37.

Panel Latch



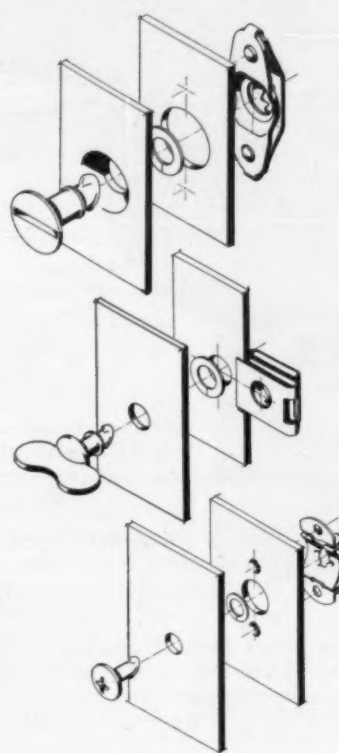
Best Application: Where spring loading, single hole mounting, and minimum inside clearance are factors.

Form: Chromed knob with arrowhead to indicate pawl position. Spring in plated ferrule applies tension to pawl.

Features: Uses only $\frac{3}{16}$ " inside space. Pushing knob relaxes operating tension.

Availability: From stock, individually packaged. *Handbook pg. 43. Other latches, pp. 38-43.

Lion 1/4 Turn Fastener

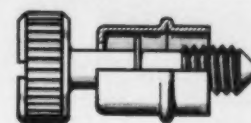


Best Application: For light weight, quick operation, vibration resistance. To meet Mil Spec. MIL-F-5591A (ASG).

Form: Swaged nose stud, retainer (to captivate stud), solid leaf receptacle. **Features:** Quarter-turn clockwise locks, quarter-turn counterclockwise unlocks. One piece stud design adds considerable strength. Clip-on receptacle speeds installation.

Availability: From stock in variety of head styles. Ten receptacles offered over the three sizes, including side-mount and casting mount. *Handbook pp. 9-18.

Retractable Screw Fastener



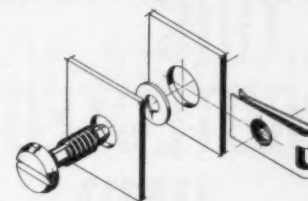
Best Application: Drawers, slides, doors, especially on electronic equipment.

Form: Polished stainless steel screw retained in standoff flanged into door. Screw engages tapped hole in frame.

Features: Screws can be used in multiples, operated individually without forcing door. Float of screw in standoff tolerates misalignment.

Availability: From stock in 5 head sizes (slotted or unslotted), 8 thread sizes from $\frac{1}{4}$ -20 to 4-40. Spring loading for automatic retraction also from stock. *Handbook pp. 18-22.

Quick-opening Screw Fastener



Best Application: Where misalignment is present, or where doors may be subject to hard use or deformation.

Form: Heavy square-threaded screw assembly held in outer panel by retainer and engaging receptacle on frame.

Features: Maximum float for ease of installation and alignment. One assembly fits variety of door and frame thicknesses.

Availability: From stock in Nos. 2 and 7 sizes. Three head styles; riveted, welded, clip-on receptacles. *Handbook pp. 23-27.

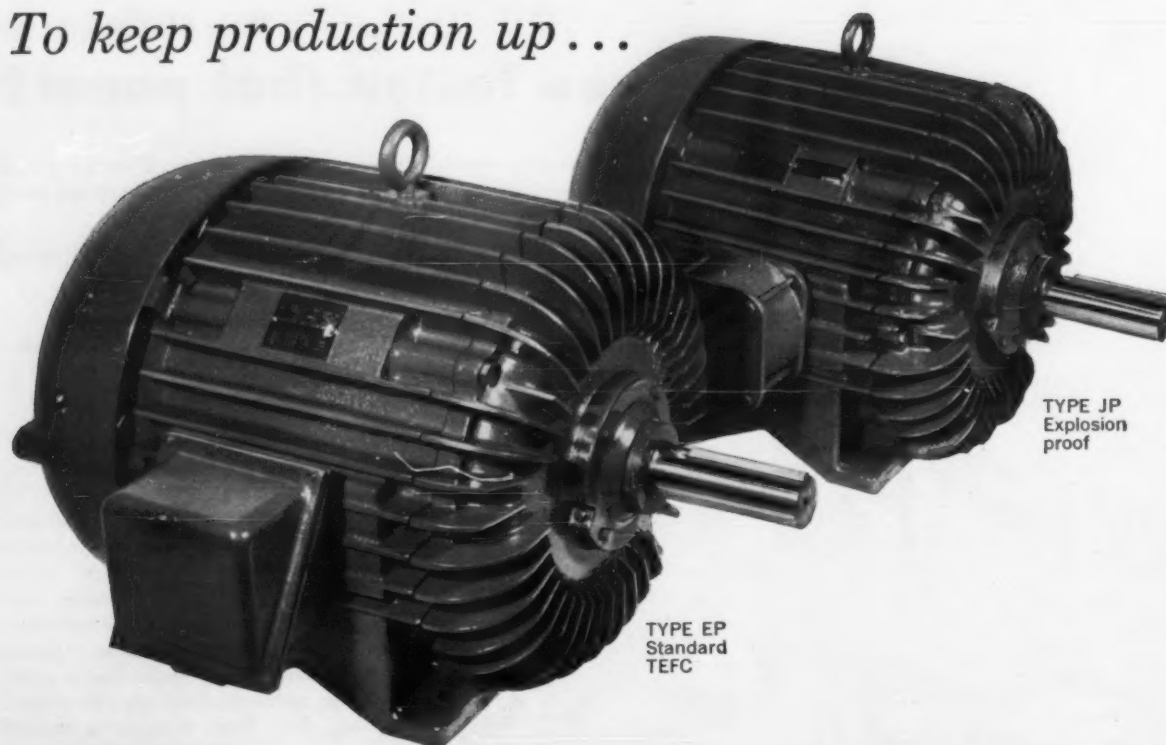
SOUTHCO FASTENERS

LION

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To keep production up...



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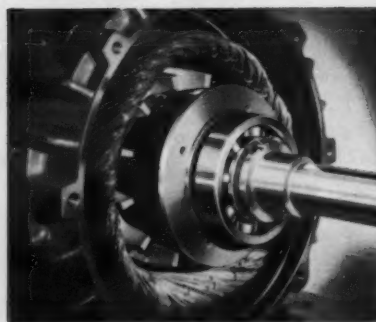
Here's a power-packed pair of Wagner® totally-enclosed fan-cooled motors—Type EP, standard, protected against damage from dust, abrasive, fumes, steel chips or filings; and Type JP, explosion-proof, for safe use in specified hazardous locations.

They'll keep your production rates up, delivering full rated horsepower under the toughest conditions... staying on the job with dependable, continuous service that means peak output. They're the perfect pick, for individual machines or for automated lines.

In the design illustrated, these motors are built in ratings through 100 hp in NEMA frame sizes 182-445U. Let your Wagner Sales Engineer show you how this protected pair (or larger Wagner enclosed motors through 500 hp) gets the job done. Call him, or write us for Bulletin MU-224.

Wagner Electric Corporation

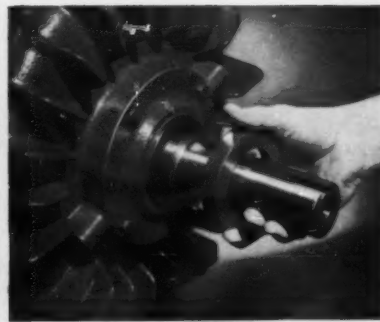
6487 PLYMOUTH AVENUE, ST. LOUIS 33, MISSOURI



HEAVY-DUTY BALL BEARINGS... The ball bearings used in these motors are of the highest quality, with more than ample capacity to provide long, troublefree service under heavy loads.



BEARINGS CAN BE RELUBRICATED... Factory lubrication will last for many years under normal service, but openings are provided to permit relubrication that adds years to motor life under severe conditions.



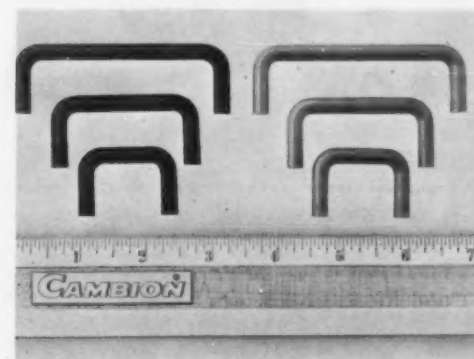
SECURELY SEALED FOR LOW MAINTENANCE... Both ends of these motors have running shaft seals to keep the bearings clean. Bearing housings are effectively sealed to prevent escape of grease.

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MECHANICAL

Plastic-Covered Handles

306

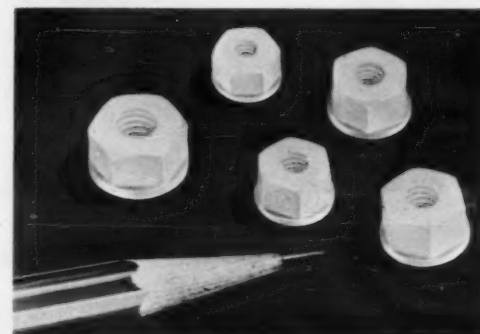


A series of brass-based handles covered with molded vinyl plastic eliminates the problem of hands sticking to bare metal in cold climates. The molded vinyl serves as an electrical insulator and is offered in a standard black color. Other colors may be especially ordered. The handles have a height of 1 inch and are available with three different widths between centers—1-1/4, 2 and 3 inches. All models are tapped for a 4/40 fastener and have a 5/32-inch OD.

Cambridge Thermionic Corp., 445 Concord Ave., Cambridge 38, Mass.

Nylon Lock Nuts

307



The use of nylon in these fasteners is said to make them ideal for locking applications and for sealing commercial liquids and gases. Design of the unit aligns the screw on the nut and holds it tightly at the center, preventing wobble, chatter and longitudinal movement. Hexagonal nylon "Brilock" lock nuts are available in seven sizes from No. 4 to 1/4 inch. They are made of du Pont's "Zytel 101" natural-colored nylon and are supplied in packages of 10 and 100 units.

Machine Parts Supply Co., 13 E. 37th St., New York 17, N.Y.

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RAMSEY CORPORATION a subsidiary of Thompson Ramo Wooldridge Inc.
Box 513, Dept. A, St. Louis 66, Missouri

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Use it as an axle... SEL-LOK spring pin



In cigarette lighter



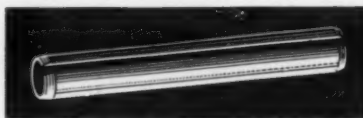
On pulley



In flow rate integrator

- Swift fastening—just drill and drive
- Secure locking—won't work loose despite shock or vibration
- Eliminates costly tapping, reaming, peening, milling
- Can be reused repeatedly
- 101 uses—as keys, cotter pins, axles, hinge pins, wrist pins, stop pins, pivots, etc.

SEL-LOK spring pins are available in carbon and corrosion-resistant steel (from $\frac{1}{16}$ x $\frac{3}{16}$ through $\frac{1}{2}$ x 4 in.) and beryllium copper ($\frac{1}{16}$ x $\frac{3}{16}$ through $\frac{1}{4}$ x $3\frac{1}{2}$ in.). See your SPS distributor or write for Bulletin 2670.



INDUSTRIAL FASTENER Division

SPS

JENKINTOWN 6, PENNSYLVANIA

Circle 21 on Reader-Service Card for more information

Potentiometer-Drive Slip Clutches

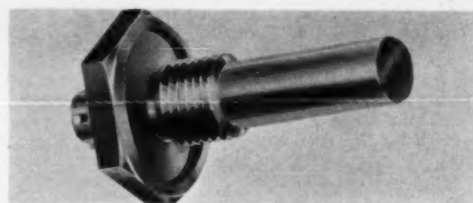
308



These clutches control or limit input torque to potentiometers used in servo systems or other power packages. They are constructed for services requiring extended periods of constant slip. The units are completely sealed and lubricated for life—which with their unusually small size makes them particularly suited for designs where space is critical. Sizes are available to accommodate potentiometer shafts of 1/8-, 3/16- and 1/4-inch dias. The clutches measure 1/4 to 5/16 inch long with OD's from 7/16 to 5/8 inch. Torque capacities are from 1 to 20 oz-in. The clutch unit is fastened to the potentiometer shaft with two set screws spaced 120 deg apart. Construction of the slip clutches allows them to maintain a given torque setting for long periods of time without the necessity of readjustment.

Sentinel Standard, 426 E. 102nd St., Brooklyn 36, N.Y.

Explosionproof Level Controller 309



By using ultrasonics, this switch gains the advantage of operating independently of fluid properties such as dielectric constant, pressure, temperature, resistivity or conductivity. The ultrasonic switch triggers instantly when any liquid touches the sensitive probe surface and it has a repeatability within thousandths of an inch. The "Sono-switch" requires no adjustment for temperature changes or pressure variations and can be used interchangeably in different fluids under the most severe conditions. The switch is suitable for gasoline, naphtha, liquid oxygen, kerosene or other flammable fluids. Uses include over-fill alarms, automatic pump start or shut-down, low-level indications and a variety of valve programming situations in explosive areas.

Powertron Ultrasonics Corp., Expressway Industrial Park, Plainview, L. I., N.Y.

Add Beauty... Lower Finish Cost with New Fasson Dec-a-tex



It's Self-Adhesive

Add luxury and distinction to your products with a finish of new Dec-a-tex. Choose from 33 colors and 12 embossed patterns . . . subtle beige kidskin to flag-red llama to shimmering copper boxcalf.

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Amazing Dec-a-tex durability is built-in by impregnating a tough kraft base with nitro-cellulose. After printing and embossing, the leather or linen-like surface resists scuffing, soiling, moisture and most chemicals.

Send for FREE literature and samples . . . now!

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An Avery Company

Dept. C, 250 Chester Street, Painesville, Ohio
In Europe: Fasson (Nederland) N.V., Leiden, Holland

Makers of self-adhesive papers • foils • films • for converters

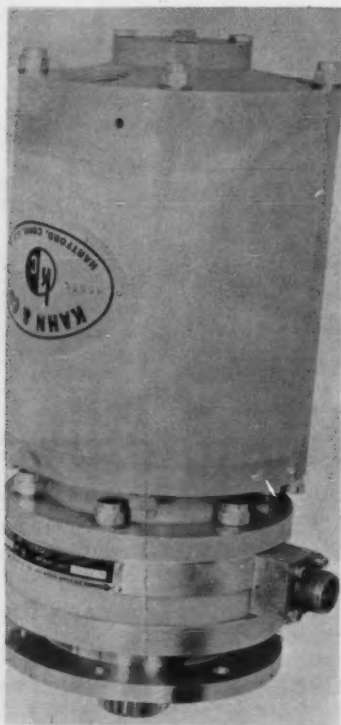
Circle 22 on Reader-Service Card for more information

MECHANICAL

Water Brake Dynamometer

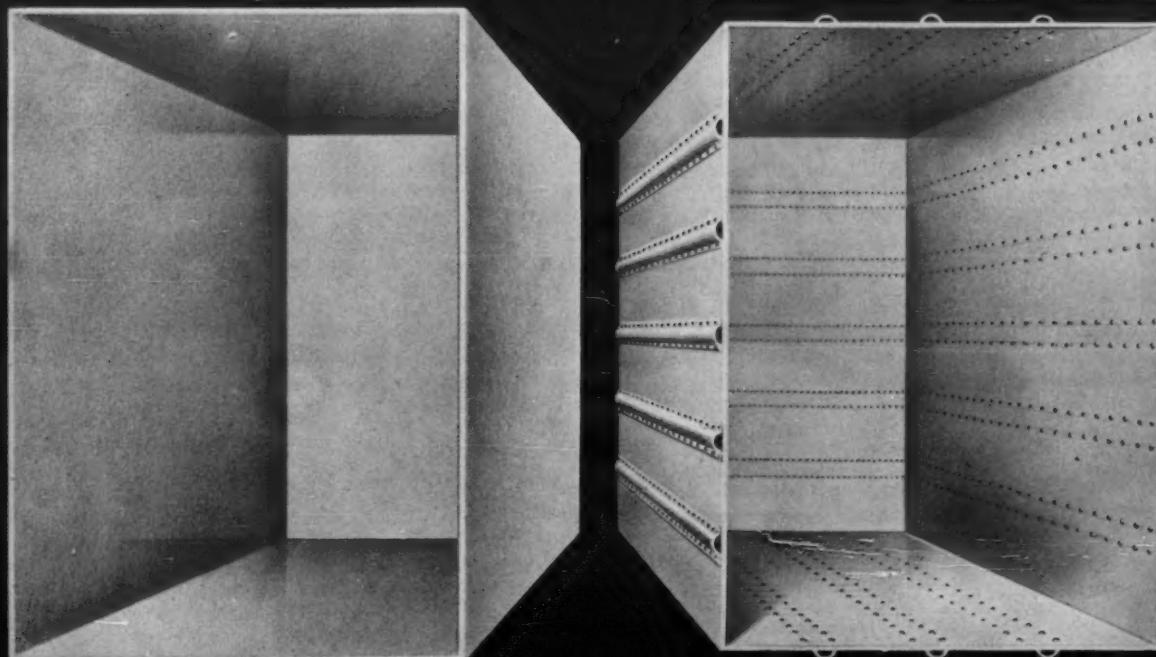
310

Brakes are offered in a number of models for power absorption up to 8000 hp at speeds to 24,000 rpm. The water brakes can be supplied as a complete package with various power-measurement devices including a rotating torque shaft, a temperature measurement system, a combination torque arm using either a platform balance scale or load cell, and the "Bytrex" nonrotating reaction torquemeter.



Water brakes will operate in either direction of rotation and can be disassembled easily for complete inspection. They are used for absorbing the shaft horsepower of engines, turbines or other rotating equipment, and furnish an economical and versatile method of measuring power output.

Kahn & Co., Inc., Box 516, Hartford 1, Conn.



NO-RIB

RIBBED

Thick-gauge magnesium sheet is so rigid that time-consuming rib stiffeners and fasteners are eliminated. Yet the magnesium panels are light and strong, resist dents and punctures better than thin-skinned ribbed construction.

WHICH HIGH-STRENGTH DESIGN WEIGHS LESS... COSTS LESS TO BUILD?

Magnesium no-rib, of course. By increasing the sheet thickness slightly, designers of containers and vehicle bodies get a tremendous boost in rigidity, thus can eliminate stiffening ribs. And since magnesium is the lightest structural metal, the resulting unit weighs less than conventionally-designed structures using other metals. (No-rib design in other metals introduces a severe weight penalty.) Magnesium no-rib structures are smooth-walled, minimize crevices for water seepage, have greater cubic capacity pound-for-pound than ribbed units. For detailed information on using magnesium no-rib construction for fabricated units of all types, write THE DOW METAL PRODUCTS COMPANY, Merchandising Department 1108AV12-22, Midland, Michigan.

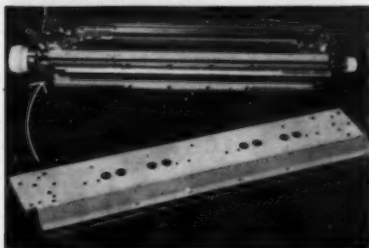
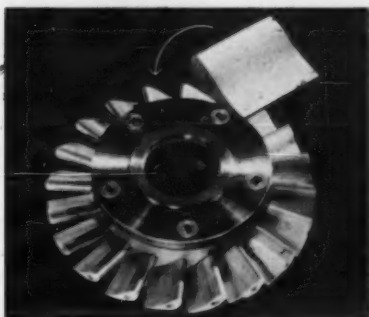


THE DOW METAL PRODUCTS COMPANY

Division of The Dow Chemical Company

DOW

THESE EXTRUDED PRECISION PARTS NEED NO MACHINING!



(above) Automotive transmission stator blade.
(below) Electric typewriter carriage part.

These parts are made from Dow precision magnesium extrusions. They required *no machining* because of close as-delivered tolerances. Such precision parts need only end trimming or cutting to length. Where transverse holes are required, only drilling and tapping are needed.

Dow precision magnesium extrusions provide tolerances as close as $\pm .001$ on critical cross-sectional dimensions, plus dimensional stability and light weight. Because machining is not needed, production costs are reduced. Precision magnesium extrusions like these are ideal for office machine parts, power-train components, and other precision equipment.

Complex extruded parts can be produced with consistent precision fits. Extruded shapes may include sharp V's, thin notches and accurate serrations. For information, write THE DOW METAL PRODUCTS COMPANY, Midland, Michigan, Merchandising Dept. 1153AV-12-22.

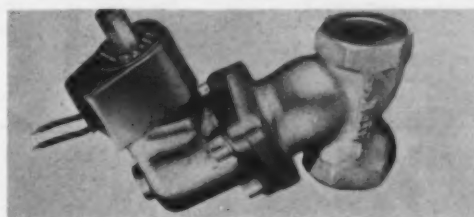


THE DOW METAL PRODUCTS COMPANY
Division of The Dow Chemical Company

Circle 23 on Reader-Service Card

Solenoid-Controlled Valve

311



Fluids normally corrosive to nonferrous materials and often found in cutting oils and coolants may be ideally controlled with this two-way, solenoid, coolant valve. The 8352 coolant valve will control the flow of coolants containing suspended solids during single or multiple grinding or cutting operations. In installations where coolants are fed from a central pressure source, the valve allows selective control of the coolant. The valve is operated with a two-way cylinder and is supplied with rugged cast-iron body and bonnets having integral flat-type seats and resilient "Viton" discs. The seat design permits a slight compression of the disc material before a metal-to-metal contact is made. Sizes are available from 3/4 to 1-1/2 inches in all standard a-c and d-c voltages.

Automatic Switch Co., Florham Park, N.J.

Electromagnetic Clutch-Brake

312



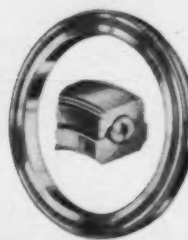
When installed between a motor and a machine, these packaged units permit the motor to run continuously while the clutch-brake gives repetitive start-stop cycling to the driven load. Torque ratings provide a liberal safety factor for drives in the 1/3- to 3/4-hp range. The "Cycledyne" electromagnetic clutch-brakes are available with conventional foot-mounted frame or C-face input. Overall length of the fhp clutch-brake is 10-1/2 inches long by 6-3/4 inches high. Units are offered in a range of sizes to meet drive requirements from 1/3 to 50 hp.

Cycledynamics Inc., 19025 W. Davison Ave., Detroit 23, Mich.

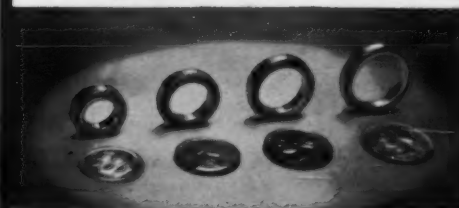
a new design concept...



HDR SERIES High precision radial ball bearings with maximum ball complements in deep groove races uninterrupted by filling slots or counterbore—extra high capacity—made in four metric series, in ABEC 3 and ABEC 5 precision grades.



T SERIES Thin-section, high precision radial ball bearings. Type TCR with maximum ball complement and retainer—Type TCF with full race ball complement—Type TWF with unique integral shield.



MIDGET T's

Small, thin-section radial ball bearings with maximum ball complements and one-piece retainers—high concentration of load capacity in minimal space results in tremendous space savings.

FUNCTIONAL ADVANTAGES EXCLUSIVE WITH PATENTED SBB BALL BEARING CONSTRUCTION

Split Ballbearings have many advantages over conventional ballbearings because of our exclusive and patented method of construction. The result is a new kind of precision ballbearing with the following superior performance abilities:

MORE LOAD CAPACITY—up to 56% more radial capacity than conventional Conrad-type bearings while maintaining full thrust capacity in either direction. **LONGER SERVICE LIFE**—up to 280% more life than conventional Conrad-type bearings, without sacrificing load capacity. **ONE-PIECE RETAINER**—strong, light, precision made. **SPACE SAVING**—more capacity in a given bearing envelope means smaller bearings may be used. **LOW TORQUE**—maximum ball complements and precision one-piece retainers provide better load distribution within the bearing, effectively reduce starting torque, and minimize running torque. **GREATER RIGIDITY, LESS DEFLECTION, INCREASED RESISTANCE TO SHOCK LOADS**—all these advantages derive from using maximum ball complements in deep groove bearings without filling notches or counterbored rings... possible only with Split's patented construction method. **INTEGRAL SHIELDS**—truly integral shields in thin-section bearings... no ring distortion. **SPECIAL DESIGNS**—Split Ballbearing's method of construction brings new solutions to difficult bearing problems. As a result, many of these incorporate special bearing designs. You are invited to consult with our Special Bearing Engineering Group for new approaches to your particularly difficult bearing problems.

split ballbearing

SBB DIVISION OF **MPB**
INCORPORATED
LEBANON, NEW HAMPSHIRE

Circle 24 on Reader-Service Card for more information

Solid-State Voltage Reference

Accuracies to better than 10 ppm, even under severe environmental conditions, now are possible using solid-state voltage reference standards. Measuring 2-9/16 inches square by 3-1/4 inches, the TC Series "Votaloc" units have outputs to 10v d-c when supplied 115v, 50 to 500 cps. Rugged and reliable, the hermetically sealed units maintain their accuracy under severe operation conditions of shock, acceleration, vibration, humidity and extremes of temperature. The voltage reference units will withstand vibrations of 10 to 60 cps at 2G for 24 hr, 20 G for 11 msec and operational temperatures of 120F. The units may be short-circuited indefinitely with the output immediately returning to normal upon removal of the short. Units undergoing life tests have been in continuous operation for five years with no failures.

Bellows-Valvair, Jackson Electronic Div., 695 Johnston St., Akron 6, Ohio.

313



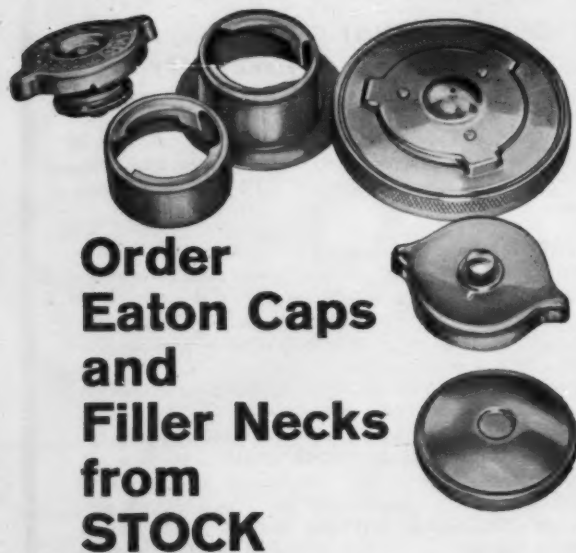
Snap-Action Switch for High Currents

314



Designed to carry a current load of 10 amps in low-resistance applications, this switch uses a self-energized spring to provide its precision snap action. The switch is suited to applications requiring repeatability, long life, small movement differential and close operating tolerances—all in a subminiature unit. The operating point of the Model 710 switch is guaranteed to remain constant, assuring its high repeatability. Unusually high contact force makes the switch safe from contact bounce, chatter, shock, vibration and dead break. Temperature range is -100 to 250F with a rated life of more than one million operations. Contact arrangement is SPDT.

U. S. Switch Corp., 7 Jefry Lane, Hicksville, N.Y.



Order Eaton Caps and Filler Necks from STOCK

Let us carry the Inventory

Immediate delivery on caps and filler necks now in production. Types and sizes for every use—automotive, marine, aircraft, tractors, motorcycles, lawn mowers, industrial engines. Genuine original equipment quality. Take advantage of our high-volume production—and save. Send for illustrated folder with specifications covering complete Eaton line.



EATON STAMPING DIVISION
MANUFACTURING COMPANY
17877 ST. CLAIR, CLEVELAND 10, OHIO

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If GEARS Are YOUR Problem

We Can...

- act as your precision gear department
- keep your production line going smoothly without shut-downs
- reduce rejects, hand adjustments or other supervisory attention
- provide you with precise gearing for any purpose whatever
- and do it with a strict adherence to safe engineering economy

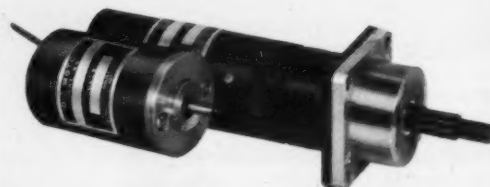
SPECIALISTS IN THE FINE PITCH FIELD

Use our more than a decade of experience in Gear making, in any material, for America's most particular users of precision or commercial gears. Send blueprints or specs for prompt estimates to



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PROCESS GEAR CO., INC.
3311 W. Newport • Chicago 18, Illinois

Circle 26 on Reader-Service Card for more information



1 1/2" MOTORS & GEARMOTORS 1000 INCH POUNDS TORQUE

Choose the exact speed-torque combination you need—up to 1000 inch-pounds (500 inch-pounds continuous). Globe's 1 1/2" pm d.c. motors alone or with planetary gearing, governor or brake give you 1/30 hp. continuous duty. With Globe 1 1/2" motors you don't need to shop for a speed reducer—just name your speed and our application engineer will recommend the ratio (22 standard ratios) and armature winding (21 standard windings). Motors are for use with 4 to 115 v.d.c. Write for Bulletin BG. Globe Industries, Inc., 1784 Stanley Avenue, Dayton 4, Ohio.



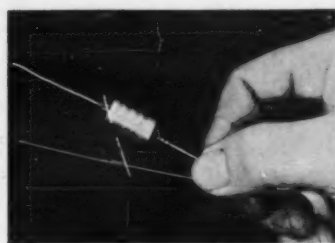
**GLOBE
INDUSTRIES,
INC.**

Circle 27 on Reader-Service Card for more information

Microminiature Solenoid RF Chokes 315

So small that 850 can be packaged in 1 cu in, these RF chokes are offered in values to 10 μ h. Having a maximum length of 0.200 inch and a dia of 0.075 inch, the chokes carry a current of from 31 to 38 ma. Twenty-five different values of inductance are available from 0.1 μ h to 10 μ h. Lab Kit No. 506 containing 13 representative values is available for prototype design.

Wells Electronics Co., 1701 S. Main St., South Bend, Ind.

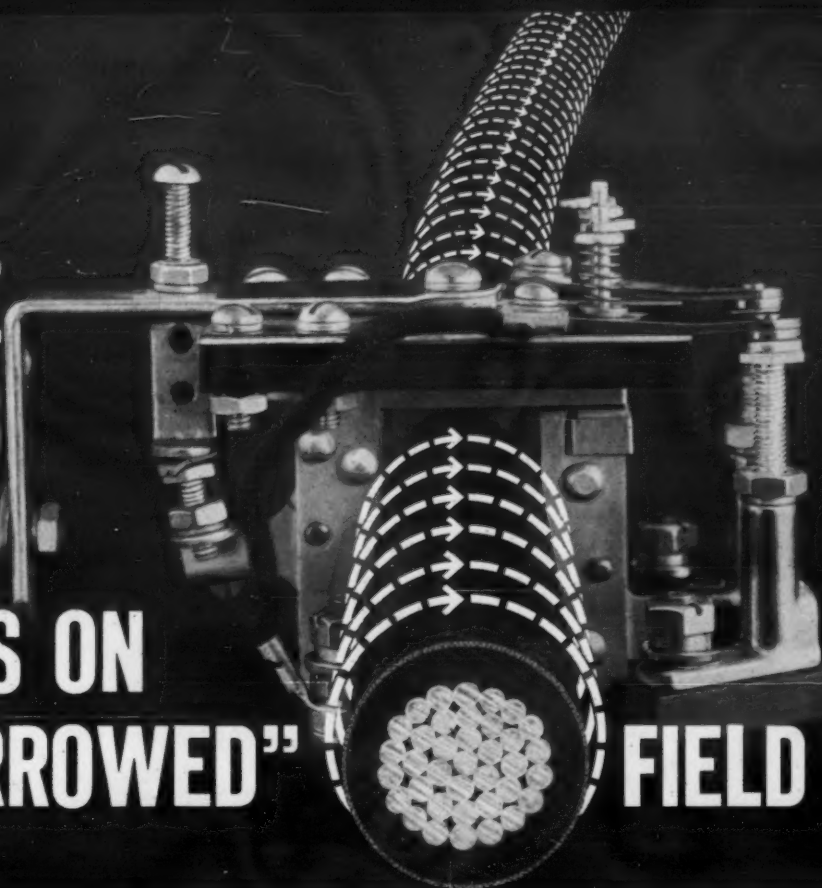


RF Shielding for Air Ducts 316

Maximum cooling and ventilation are provided with effective shielding against electromagnetic energy with these "Attenu-duct" filters. They are made of a light-weight welded and plated honey-combed steel. Standard module is 2 by 4 ft with frames, although units can be manufactured in any size and with any type of mounting. The ducts are made to cover the frequency range from 150 kc to more than 3000 Mc and provide attenuation in increments of 27 db (27 db, 54 db, 81 db). With an air velocity of 1200 fpm, the maximum static pressure is only 0.1 inch of water. In applications having extreme heat, humidity or corrosion, stainless-steel ducts are obtainable to meet the requirements. The air-duct filters are used to provide maximum protection to personnel or electronic equipment in shielded enclosures and buildings located in or near high-powered radar installations.

Filtron Co., Inc., 131-15 Fowler Ave., Flushing 55, N. Y.

UNIQUE COILLESS RELAY OPERATES ON "BORROWED" FIELD



Controls Secondary Circuits in Response to Load-Cable Current

The Coilless Relay, one of many ASCO specialized relays, is essentially a current-sensing device. Designed to function like a current transformer, the load cable through the relay provides the magnetic field for operation.

Specifications — Cable Sizes to 3/4" OD ■ Pick-Up—130 Amp. (AC or DC) ■ Drop-Out—20-30 Amp. (AC or DC) ■ Contact Rating—15 Amp. at 250 V. AC (Noninductive load) ■ 1-3 Poles.

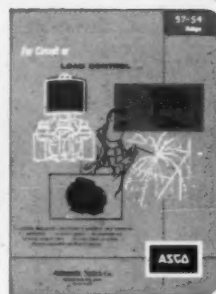
Applications—When applied on continuous-welding installations, the load cable connected to the welding electrodes passes through the relay. The relay operates as a function of welding current to control the material-feed motor.

As an instantaneous-response over-current relay, this coilless device monitors both branches of a single-phase, three-wire system; the live line cables are passed through the relay in opposite directions producing in function a kva response relay. ASCO Coilless Relays are also available for control purposes with high-frequency induction furnaces to 10,000 cycles.

The versatility of the ASCO Coilless Relay, its heavy power-relay construction, and the flexibility of its basic design, mean adaptability to spare in the solution of engineering problems wherever current-sensing relays are applicable.

Features: Ease of Installation—cable-passes through relay—does not have to terminate at relay.

- Pick-up at relatively low currents assured by highly efficient magnetic circuit.
- Long life and low maintenance costs ensured by Oilite bearings.
- Available for either ac or dc control.
- Pure silver contacts with wiping action.
- May be mounted in any position.



Coilless Relays are only part of the complete ASCO line. Catalog 57-S4 lists magnetically and mechanically held relays to 24 poles, 10 and 25 amperes, along with many specialized types; reverse current, close differential, time delay, electronic, and modified arrangements. Write for your copy of Catalog 57-S4 today!

ASCO Electromagnetic Control

ASCO

DEPENDABLE CONTROL BY Automatic Switch Co. 560 HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

EPIALL molding compounds combine the inherent properties of epoxy resins with those of a wide range of fillers and reinforcing materials under Mesa's high standard of quality control. Dimensional stability is maintained at elevated temperature with freedom from out-gassing. High arc resistance (to 180 seconds), dielectric strength, and insulating capability are retained under conditions of extreme temperature and humidity. EPIALL compounds can be molded using conventional techniques. Good shelf stability (over four months without refrigeration), fast cure, hot rigidity, and fine mold release characteristics provide workability not found in other epoxy compounds. Please write direct for complete details of either conventional or "encapsulation grade" EPIALL molding compounds. Mesa Plastics Company, 12270 Nebraska Ave., Los Angeles 25, Calif. BR 2-4471.

new reliability in epoxy



MESA

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Low
cost
surgically
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X-ACTO REFILL BLADE KNIVES

- 28 BLADE SHAPES
- 12 HANDLE STYLES

TRY-IT-YOURSELF OFFER! Two different handles (light & medium duty) and 10 assorted blades in plastic case—Special \$2.00 (Reg. \$2.75).



X-ACTO PRECISION TOOLS, INC.

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Company _____

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City _____

Zone _____ State _____

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MATERIALS

High-Dielectric Constant Material

317

Manufactured in sheets up to 15 by 15 inches and in thicknesses to 1/2 inch, this material can be supplied with either one or two easily etched copper-clad surfaces. "Rexolite 600" has a dielectric constant of 6 (± 0.2) in the 10^6 to 10^{10} cycle range and a dissipation factor below 0.002. Applications include tuned circuits and flat-strip transmission lines.

American Enka Corp., Brand-Rex Div., 31 Sudbury Rd., Concord, Mass.

Ductile Pure Cobalt

318

A powder rolling process has made possible this ductile, workable strip of pure cobalt. Cobalt powder with very low impurity levels is used as a starting material which, together with close control of annealing conditions, contributes to the increase in ductility at room temperature. The material is said to be the first cobalt workable enough for conven-



tional metalworking techniques. The coil illustrated weighs 174 lb, is 0.049 inch thick, 6 inches wide and 145 ft long. Cobalt exhibits excellent corrosion resistance, good electrical and magnetic properties and high temperature strength.

Sherritt Gordon Mines, Ltd., c/o Harry P. Bridge Co., 1201 Chestnut St., Philadelphia 7, Pa.

Lepel

High Frequency
**INDUCTION
HEATING
UNITS**

Lepel induction heating equipment is the most practical and efficient source of heat developed for numerous industrial applications

LEPEL ELECTRONIC TUBE GENERATORS

STANDARD UNITS

Frequencies: 180 Kc to 600 Kc
Sizes: 1 Kw to 100 Kw output

MEGACYCLE UNITS

Frequencies: 3 Mc to 50 Mc
Sizes: 2 1/2 Kw to 20 Kw output

DUAL FREQUENCY UNITS

Sizes: 5 Kw, 10 Kw & 20 Kw output

LEPEL SPARK GAP CONVERTERS

Frequencies: 400 Kc to 900 Kc
Sizes: 2 Kw to 30 Kw input



BRAZING

SOLDERING

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ANNEALING

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PLASMA TORCH



LEPEL LABORATORY SERVICE

Lepel maintains a fully equipped laboratory where experienced induction heating engineers will process your work samples and submit complete laboratory reports and recommendations without any obligation.

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LABORATORIES, INC.**

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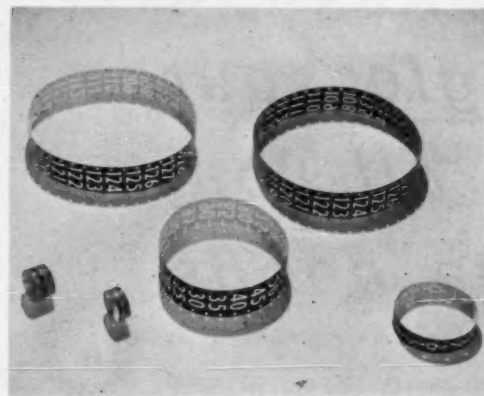


Roll forming is used to produce these miniature metal sections. Intended for industrial uses, many of these items are maintained in stock or may be produced on a custom basis. The light-gage roll-formed aluminum is obtainable in angles, channels and tubes and in many other shapes.

Universal Molding Co., Lynwood, Calif.

Instrument Scale Tape

320



This numbered tape can be illuminated either from in front or behind when used in vertical-scale display instruments, counters or other indicating instruments. The tape possesses high dimensional stability, abrasion resistance and excellent flexibility. It may be obtained in endless-belt form and has exceptional strength at the splice. Light transmission values up to 50 percent for white characters can be obtained. Colors are available. Light transmission values depend on the selected color. The extremely sharp, clear, accurate reproduction of characters and figures is possible by a photographic process. Two thicknesses are offered—0.004 and 0.005 inch.

Gentape Corp., 51 LaFrance Ave., Bloomfield, N.J.



Humidifier CMPC-molded for lifetime service

The Aprilaire® high-capacity furnace humidifier will never have a problem from heat, rust or corrosive impurities of water. Manufactured by Research Products Corporation, its housing is of CMPC-molded special-purpose phenolic . . . designed to permit easy accessibility for inspection and maintenance if necessary. The motor housing, drain pan and distributing pan are all integral molded-in parts of the neat, compact main housing. A bonus feature is soundproofing—helping make the unit whispering quiet.

To improve your products, or to meet one of those "difficult" manufacturing situations where a plastic is the answer—see your Chicago Molded Engineer . . . He'll have the solution for you!

Send for new brochure "Design and Purchase of Custom Molded Plastics".

CMPC

CHICAGO MOLDED PRODUCTS CORPORATION
1020 S North Kolmar Avenue
Chicago 51, Illinois

EQUIPMENT

Tuning-Fork Controlled Timer 321

Guaranteed accuracy to within 2 sec per day has been developed by using this tuning-fork controlled electronic timepiece. The timer is operated by a self-contained mercury power cell, having a life of more than one year. The unit is available with either germanium or silicon transistors, depending on the temperature requirements. The timer is supplied with a dull, black-background dial with white markings and hands, in either 12- or 24-hr models. Hour and minute hands are set at the rear of the timer and a hack feature may be requested for setting the second hand.

Bulova Watch Co., Inc., Flushing 70, N.Y.

Closed-Circuit TV Transmitter 322

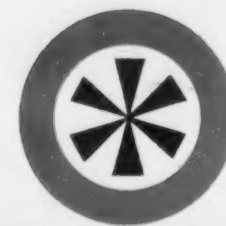


This closed-circuit television transmitter may be used with any VHF television receiver. The transmitter feeds audio and/or video into a closed-circuit system on an unused VHF channel. Composite output of the unit is 0.1v. Three audio inputs are provided to accept signals from a microphone, a tape recorder or a 70v audio line. The A-V transmitter features transformer isolation, d-c restoration, small size and weight of approximately 6 lb. The unit may be used for educational TV programming, institutional needs, for making local announcements in hotels or for monitoring processes in factories.

Marsan Industries, Inc., American Telecircuits Div., 49 Edison Place, Newark, N.J.

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General Electric—West Lynn
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Diamond Ordnance Fuze Laboratories
U. S. Naval Ordnance Lab.
Minneapolis-Honeywell/Heiland
The Bendix Corporation
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Northrop Corporation
Air Materiel Command
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Hamilton Standard/United
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Amper Corporation
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Minneapolis-Honeywell/Aeronautical Div.
The Hallicrafters Company
Bendix—Towson, Maryland
General Electric—Valley Forge
Raytheon Co.



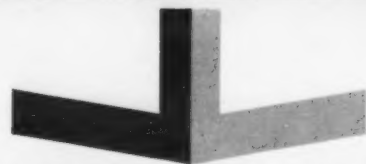
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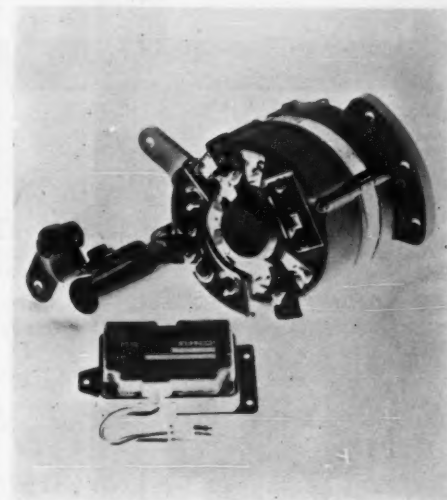
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EQUIPMENT

All-Electronic Alternator System

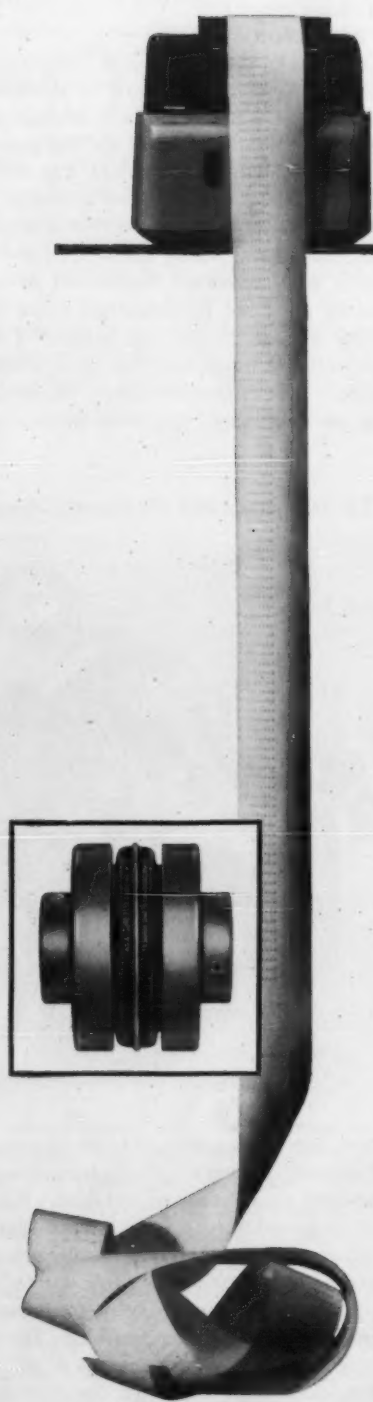
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Offered to U. S. car owners as a replacement unit, this system consists of an alternator, a universal installation kit and a voltage regulator. The system replaces the d-c generator and its regulator in standard automobiles. Unlike the d-c generator, an alternator continues to charge the battery, even at engine idle. The owner whose car is equipped with power seats, windows, heater and air-conditioning need not be concerned about insufficient charge to his car battery. Taxicab companies or businesses, having auto or truck fleets where continuous stopping and starting are necessary, now have an answer to



their battery maintenance problems. The alternator system's all-electronic voltage regulator uses transistors and diodes throughout. It is said to have an unlimited operating life, since it has no relays, buzzers or contact points. The regulator is designed to never require adjustment, which eliminates the possibility of improper servicing. The alternator systems will be available in 30- or 45-amp units to fit most 12v, negative-ground automobiles built since 1959. The system will carry a three-year or 30,000-mile guarantee on repair or replacement of parts.

Motorola, Inc., 9401 W. Grand Ave., Franklin Park, Ill.



IT ALL
ADDS UP
TO THIS ...

**YOU CAN'T BUY
SURE-FLEX
PERFORMANCE
IN ANY OTHER
COUPLING AT
TWICE THE PRICE**

Wood's Sure-Flex Couplings not only have full, 4-way flexing action, but absorb from 5 to 15 times more shock and vibration than other leading flexible couplings. They swallow all types and combinations of angular and parallel misalignment and end float. Sure-Flex couplings are simple, easy to install. Standard models have only 4 basic parts . . . no bolts, nuts, screws, clamps or covers. And, they last endlessly (6¼ million 15° peak torque flexes with no sign of wear). There's no metal-to-metal contact, no wear, no need for lubrication. Available in capacities up to 500 hp at unity service factor . . . in standard, junior, bushed and spacer types. There's a lot more to tell about Sure-Flex.



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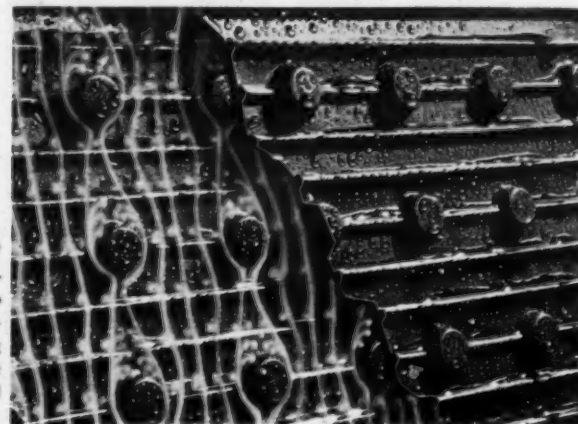
DESIGN
DESIGN IDEAS
NEWS

MATERIALS

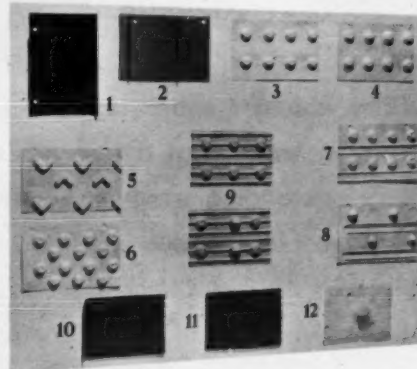
Patterned, Plastic Sheets

Provide Wettable Surface for Cooling Tower Deck

E. J. Stefanides, Central States Editor

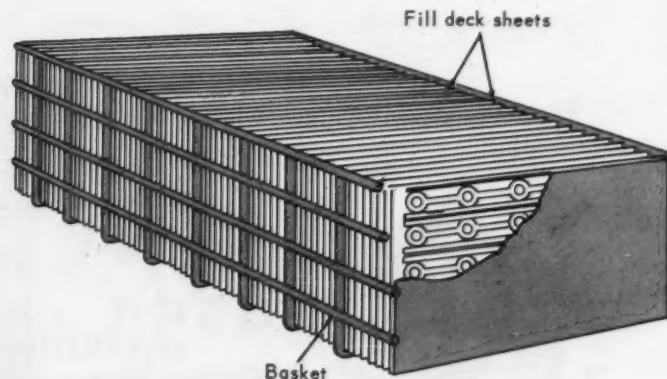


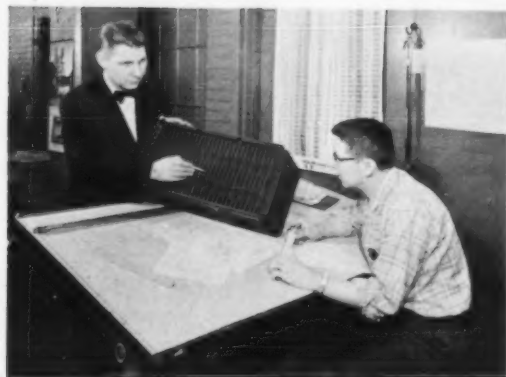
DECKING DESIGN uses button-and-rib pattern on plastic sheet to spread water on nonwetable surface. Buttons also improve cooling function by creating turbulence in upcoming air at water spread joints.



DECK SHEET DESIGNS evolved and tested in developing decking pattern. Though unsuccessful, each contributed to greater understanding of basic problem and its eventual solution.

DECKING for counter-flow cooling tower is especially molded of polystyrene sheets and arranged in vertically stacked fill decks. Mounted in hot-dipped, galvanized wire baskets, decking slides out easily for inspection or cleaning.





The decking of a new line of counter-flow cooling towers for the air conditioning and refrigeration industry is made of tough, chemically inert, polystyrene plastic sheets. Molded into the surface of these sheets is a pattern of conical projections and horizontal spreader ribs which provide for optimum control of the air-water mixture for maximum heat transfer. The end result is a compact, efficient cooling tower design with a strong, lightweight, inexpensive decking which will not deteriorate.

Of the materials investigated, the polystyrenes offered the best combination of properties. However, they had one serious disadvantage: the nonwettability characteristics of the plastic surface. Water poured over a sheet of the material would not spread out into the thin film required to provide maximum use of the surface for a given water volume.

The principal design problem, then, was: How to get a wettable surface? Abrading, chemical etching, even painting were tried without success.

Mechanical design changes involving the molding of various configurations into the surface of the sheet next were investigated. In this phase, a wide variety of patterns was designed and tested, each proving unsuccessful, but each contributing to a more comprehensive understanding of the basic problem and its eventual solution.

The final design incorporates a combination of regularly spaced, molded conical button projections and horizontal spreader rails to precisely control the parallel, but opposite in direction flow of water and air through the tower. The buttons control the turbulence of the air as it is forced up from the bottom. The spreader ribs fan the downward flowing water out into thin sheets. Key buttons also are molded on the opposite side of the sheet to maintain clearance between sheets and prevent them from shifting in the galvanized wire baskets which hold the sheets in position in the tower.

This decking design is a development of Acme Industries, Inc., Jackson, Mich.



TD-44-1100 Series

From TWIN DISC comes another outstanding new

CONSTANT-MESH TRANSMISSION

for engines up to 225 hp

four speeds forward
four speeds reverse

Single-Stage Torque Converter

Power Shift Transmission

full power shifting in all speeds...

Joining the TA-51-2000 and the TD-44-400 Series in Twin Disc's new power-shift transmission line is the TD-44-1100 Series. This four-speed forward, four-speed reverse drop box features full power-shifting in all ratios. Two models are currently in production: Model TD-44-1101 with an overall ratio coverage of 5.92:1, and Model TD-44-1102 with a 7.11:1 coverage.

Important TD-44-1100 Series design features:

- Constant-mesh spur gear construction avoids the complexities of planetary design.

- Gears are shifted automatically by three multiple-disc duplex clutches. Oil-cooled and hydraulically-actuated, these space-saving clutches contain a unique valve mechanism which admits oil instantly to provide smooth, split-second response.

- Movement of speed selector valve stem gives four speed selections; movement of directional control valve stem offers forward, neutral and reverse positions. Shift to neutral is

automatic when brakes are applied. Separate oil pressure line prevents range clutch downshifting when transmission is in neutral.

- Standard equipment includes yoke-type U-joints on the input shaft and both ends of the output shaft, plus a 13" parking brake and a disconnect jaw clutch on the output shaft. Engagement of the jaw clutch provides four-wheel drive.

The TD-44-1100 Series transmission is normally furnished as a package unit with a Twin Disc 1500 Series

Single-Stage Torque Converter. This sumplex, rotating-housing converter has a net input capacity of 225 hp at 2100 rpm. It can be supplied with either rubber block or metal gear tooth input drive, single or duplex pump, and an optional governor drive.

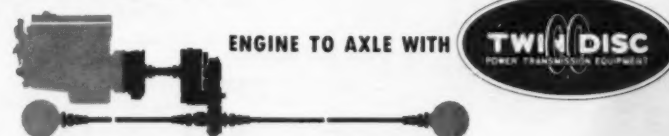
For complete engineering details and application recommendations on the TD-44-1101 and TD-44-1102 write:

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin.

SPECIFICATIONS

Model	Forward & Reverse Ratios				Nominal Rating	Maximum Absorbed Engine Torque by Torque Converter	Maximum Converter Output Stall Torque
	1st	2nd	3rd	4th			
TD-44-1101	3.90	2.16	1.19	.66	225 HP @ 2100 RPM*	560 LBS.-FT.	1790 LBS.-FT.
TD-44-1102	4.68	2.59	1.19	.66			

*Maximum Input Speed—2200 RPM



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Choosing *exactly* the right bearing can mean a vital difference in performance, cost and product life. That's why it pays to call Torrington first.

Torrington makes *every* basic type of anti-friction bearing . . . can advise you *impartially* on the best bearing for *your* application. Needle, roller or ball . . . you won't find finer bearings than Torrington. Specify with confidence. If you have a bearing problem, call or write us today. Send for catalog information.

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bearing efficiency and long life under toughest shock conditions. **4. ROLLER THRUST BEARING.** Precision built for outstanding performance. Large Controlled Contour rollers for maximum capacity. **5. SELF-ALIGNING BALL BUSHING.** Low cost unit for top performance in rugged applications. **6. SPHERICAL ROLLER BEARING PILLOW BLOCK.** High radial and thrust capacity. Fast, easy installation. Grease or oil-bath lubrication. **7. NEEDLE THRUST BEARING.** Unequalled capacity for size and weight. Runs directly on hardened ground surfaces, or on standard thrust races. **8. CAM FOLLOWER.** Exceptional combination of high capacity, maximum toughness, dependable performance under shock loads. **9. SPHERICAL ROLLER BEARING.** Precision engineered for maximum efficiency, optimum service life. Self-aligning.

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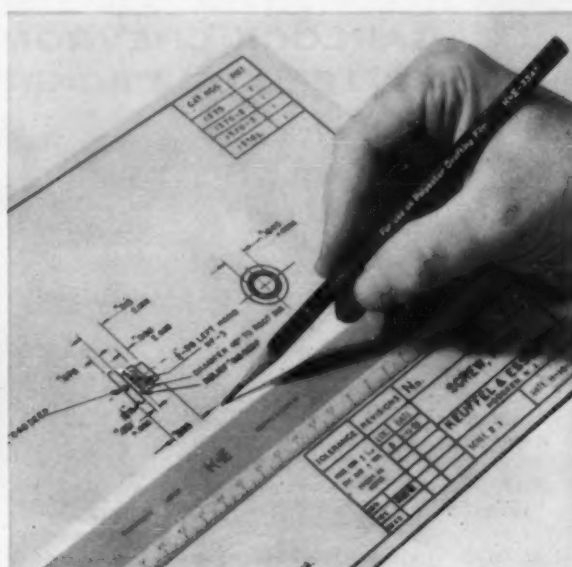
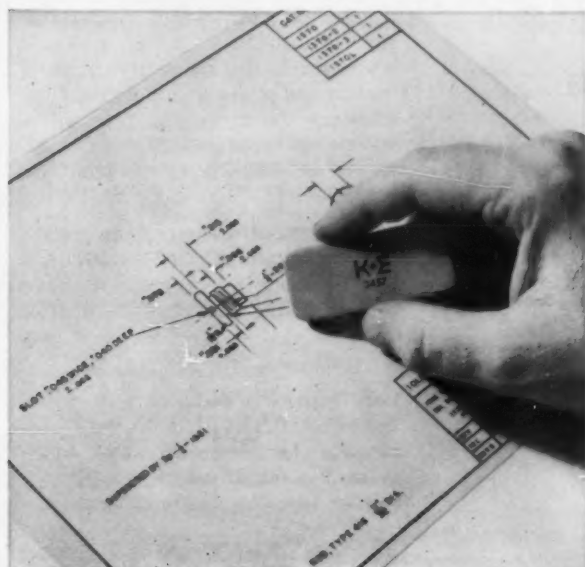
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For engineering "duplicate originals" ...

Use the Polyester Films you can work on



PHOTACT[®] by K&E

To perfect an engineering drawing requires constant revision, addition and change. Yet most photographic polyester films on the market today reflect a disregard for this fact by combining photo emulsion and drafting surface in a single surface layer. If you mechanically erase image lines on these films the drafting surface is removed, and pencil or ink will no longer take on the film surface. The only alternative is to use eradicators, a time-wasting, nerve-frazzling process.

Only PHOTACT Polyester Films have an additional drafting surface *beneath* the photo emulsion. No eradicators needed. Repeated erasures easily made. In short, the answer to a draftsman's prayers.

Erase cleanly. Using a mildly abrasive Van Dyke eraser (K&E 3457) image lines can be whisked off completely in nothing flat. Even tight, detail lines which are too tightly arranged for eradicators can be removed with a stick-pencil eraser.

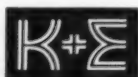
Re-draw Repeatedly. The matchless K&E engineered drafting surface won't lose its "take" or erasing qualities

even after many revisions, one on top of the other. To apply lines of ink-like density, we recommend one of a wide range of new Ruwe plastic-graphite pencils or drawing leads.

Get Perfect Duplicates and Prints. The PHOTACT emulsion yields solid blacks, true to the original drawing with no fill-in or drop-out. Wide exposure latitude almost guarantees that the first exposure is the right one. Prints are developed in regular paper developer; high-priced, short-lived litho developers are not necessary.

PHOTACT Polyester Films are available in three basic types—Contact (409) for same-size exposure; Direct Positive (411) for same-size positives from transparent originals; Projection (419) for prints from microfilm negatives.

FREE ... New PHOTACT Selection Guide. Just off the press, K&E has available a new guide to the use and selection of PHOTACT materials. It's crammed full of time-saving tips, quick-reference charts and processing hints. Your copy is free for the asking. See your local K&E dealer or fill out and mail the coupon below.



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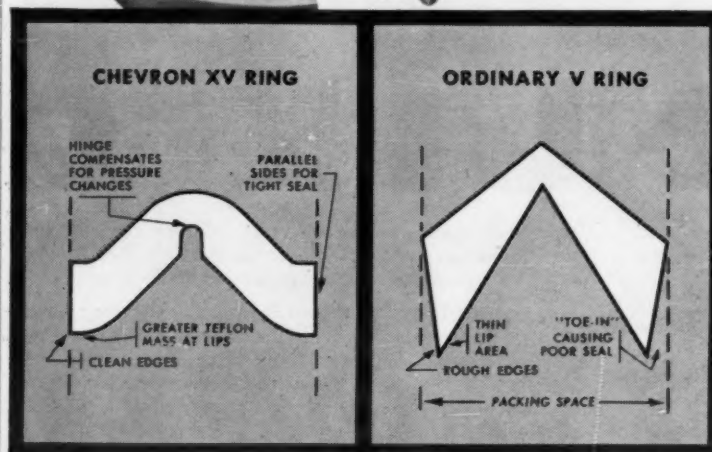
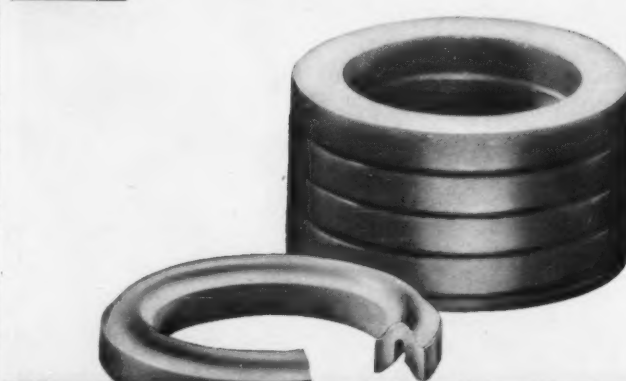
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NEW

GARLOCK CHEVRON* XV TEFLON† PACKING

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Can be molded precisely. The greater material mass of CHEVRON XV permits molding to consistent close tolerances ring after ring—batch after batch. Result—perfect fit, clean lips, far better sealing.

Ends frequent gland adjustment. The exclusive CHEVRON hinge compensates for pressure changes automatically. With proper installation, further adjustments are eliminated.

Greatly extends wear. Greater material mass and parallel sides give Garlock CHEVRON XV PACKINGS much more working Teflon than ordinary V-rings. Sturdier size for size, they wear considerably longer . . . yet cost you no more.

Virtually ends friction because of two factors. First, Teflon has the lowest coefficient of breakaway and running friction of any solid material in use today. Second, the exclusive CHEVRON hinge action permits free operation with minimum friction at all pressures.

Learn the full story of this superior new packing. Discuss your particular needs with your Garlock representative. Call him at the nearest of 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-192, Garlock Inc., Palmyra, New York.

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Compact cartridge pumps provide pressure lubrication at minimum cost

by E. H. Schanzlin

Chief Engineer, Tuthill Pump Company

An opportunity for savings exists in many original equipment applications involving pressure lubrication . . . where, in many instances, foresight on the part of the designer will permit the use of a "cartridge" pump which can be built directly into the equipment . . . to provide the greatest possible capacity per cubic inch of pump . . . and ordinarily at a price below those for comparable pumps . . . since every possible extraneous element has been eliminated from their design.

14 Different Units

To meet the requirements of these applications Tuthill engineers have developed four different models of cartridge pumps . . . each offered in 3 or 4 sizes for a total of 14 different units . . . for pressures to 200 psi . . . with a capacity range from 56 to 720 gph depending upon pump size and motor speed. These units are all available from stock in any quantity desired. They have been used successfully in many outstanding original equipment applications.

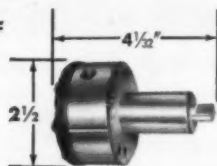
Model LF

Model LF pumps, as shown, have an extremely simple housing and are normally furnished without seals. They are supplied in three sizes with nominal capacities as shown below.

Size	GPH	RPM
00	56	1800
0	105	1800
1	180	1800

(These nominal capacities will also apply to similar sizes of pumps discussed later.)

Model LF



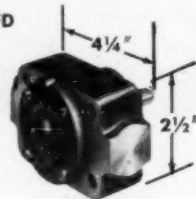
Tuthill manufactures a complete line of positive displacement rotary pumps in capacities from 1/3 to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.

Model LF pumps are designed for flange mounting. They offer a choice of internal or external porting. Overall dimensions of these compact units are only 2 1/4" x 4 1/2", and even shorter lengths are possible when pumping conditions permit.

Model LFD

Model LFD cartridge pumps are offered in the same capacity ranges and sizes as model LF. They resemble these basic pumps except that they are provided with a more detailed housing. Model LFD's are designed for flange mounting and normally supplied with either internal porting or 3/4"-18 N.P.T. external porting. Shaft seals or ball bearings may also be furnished with these units as an alternate. In the 00, 0, and 1 pump sizes, these units measure 4 1/4" x 2 1/2" x 3 1/2".

Model LFD



Model LFD pumps are also furnished in pump size 2, with a capacity of 360 gph at 1800 rpm, and 720 gph at 3600 rpm. Overall dimensions are 5 5/8" x 3 3/4" x 4 1/2".

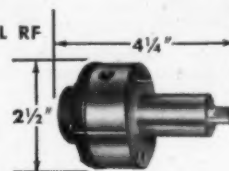
RF Models

The selection of RF models closely resembles those in the LF range . . . sizes, capacities and general characteristics are identical. However, these units are equipped with Tuthill's special automatic reversing feature which permits driving the pump in either direction without changing the direction of flow . . . with port positions remaining constant . . . without special valving.

The automatic reversing design was developed by Tuthill for applications where the pump must be driven by reversing shafts, or where

machinery must be shipped without knowing the ultimate direction of the driving unit. These versatile units have proven their superiority in hundreds of demanding applications.

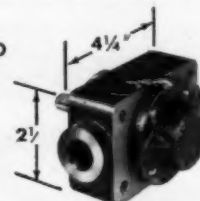
Model RF



Model RFD

These units parallel model LFD in capacities, sizes, and general characteristics. Like the model RF above, however, the pumping units have Tuthill's special automatic reversing feature for use with reversing shafts. Dimensions of 00, 0, and 1 sizes are 4 1/4" x 2 1/2" x 3 3/4". Size 2 pumps measure 5 5/8" x 3 3/4" x 4 1/2".

Model RFD



Wide Variety of Alternates

In addition to the basic pump models, various alternates can be provided. For example two alternate shaft modifications are offered for maximum adaptability.

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For further details write for catalog section 108. Or, send details on your application so Tuthill can offer suggestions on how these units can be incorporated into your design.



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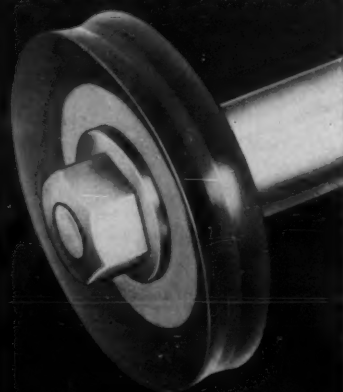
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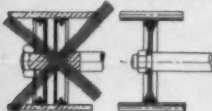
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NEW LITERATURE

Brazing Alloy Chart 451

Data on the 300 and 400 series, 17-7PH, PH 15-7MO and Am-350 stainless steels are presented in chart form. Brazing alloys, fluxes and atmospheres recommended for joining the steels are given along with typical applications, melting and flow point of alloys most commonly used for brazing stainless steel. Handy & Harman, 850 Third Ave., New York 22, N.Y.

Protective Coatings for Electronic Applications 452

Thermal, physical, chemical and electrical characteristics of protective coatings for electronic applications are provided in useful chart form. No. C-503 fold-out chart gives revised information on 10 protective coating types, broken down by AIEE thermal classification, as well as 47 other specific characteristics for each type. The reverse side of the chart contains a selector table, which gives the most suitable coating for a desired property, and a temperature conversion table. Columbia Technical Corp., 61-02 31st Ave., Woodside 77, N.Y.

Precision Welding Guide 453

Printed on heavy card stock, a two-color chart gives the "do's" and "don't's" of precision welding. Illustrations show 14 major tips for better welding, particularly where precise, highly reliable welds are required. The reverse side of the guide provides a checklist for correcting unsatisfactory welds and instructions for solving specific welding problems. Raytheon Co., Commercial Apparatus & Systems Div., 225 Crescent St., Waltham 54, Mass.

Analytical Procedures with Radioactive Isotopes 454

A collection of papers to introduce practical isotope procedures. Each of the eight papers in the 32-page manual contains procedure diagrams, appropriate graphs, photographs of instrumentation, background material and reference. Included in the titles of the papers are: "How to Use Radioisotopic Yield Determination in Quantitative Analysis"; "How to Use Radioisotopic Analysis for Mixing Analysis"; "How to Evaluate an Analytical Method with the Aid of Radioisotopes", and "How to Make Quantitative Determinations by Radiometric Analysis". Nuclear-Chicago Corp., 359 E. Howard Ave., Des Plaines, Ill.

Transistor Load Impedance Nomogram 455

Entitled "Transistor Load Impedance and Dissipation", this nomogram is for use in design of Class A and Class B transformer-coupled transistor audio and servo amplifiers. Use of the nomogram will save time for design engineers in determining required primary and secondary impedances of output and driver transformers. Microtran Co., Inc., 145 E. Mineola Ave., Valley Stream, N.Y.

Wire and Cable Selector 456

Designed as a tool in choosing the appropriate constructions, this wire and cable selector gives primary insulation information, color code, minimum coverage and jacket over braid for lead wire, coaxial cables and multiconductor cables. A color-coding guide for solid color of wire and stripe colors is provided on the reverse side of the chart. L. Frank Markel & Sons, Norristown, Pa.

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Robertshaw



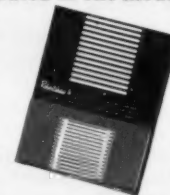
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Overseas: International Marketing Division, 911 E. Broad St., Richmond, Va.

Electrical Insulating Materials

457

An eight-page products list contains a fabricated slot insulator availability chart and an index and cross-reference of manufactured and fabricated electrical insulating materials. A material property comparison chart gives factors in the selection of the correct insulator material. Inmanco, Inc., 571 W. Washington Blvd., Chicago 6, Ill.

Copper-Zirconium Alloy

458

A technical survey of the various properties of a copper-zirconium alloy, "Amzirc", is presented in a 36-page handbook. The nature of "Amzirc" is discussed as well as fabrication, room temperature and elevated temperature properties and applications. A process properties guide is included, with numerous charts and graphs depicting the alloy's resistance to fatigue, bending characteristics, ductility and stress-to-rupture properties. American Metal Climax, Inc., 1270 Avenue of the Americas, New York 20, N.Y.

Industrial Process Instruments

459

Describes "ElectroniK" instruments, "ElectriK" and pneumatic "Tel-O-Set" lines, millivoltmeters, primary sensors, filled-system thermometers, pressure gages and transmitters. Catalog G-1a, 50 pages, also details flow and liquid level meters, "Dur-O-Pulse" telemetering systems, computers and data-handling systems, industrial controls and special purpose instruments. Photographs and specifications of the units are included. Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrim Aves., Philadelphia 44, Pa.

To obtain copies of numbered literature . . . circle appropriate number on Reader Service card.

Antifriction Bearing Manual

460

Intended for aircraft and missile design engineers concerned with antifriction bearing application, this 44-page, three-ring manual contains one section of engineering data which includes application analysis for proper bearing selection, load-carrying capacity and life, reliability, tolerances, lubrication and permissible speeds. Other sections include a series of tabulations on radial, angular-contact, cylindrical and split inner ring bearings, and complete information on the company's line of instrument bearings. SKF Industries, Inc., Front St. & Erie Ave., Philadelphia 32, Pa.

Alloy-Steel Mechanical Tubing

461

This 42-page technical and metallurgical data book describes basic characteristics and recommended procedures for 52100 alloy-steel tubing. Charts, diagrams and photographs are used in the presentation and a special section details how alloy-steel tubing is made, how to select tubing and shows tables of temperature and hardness conversion. Peterson Steels, Inc., Union, N.J.

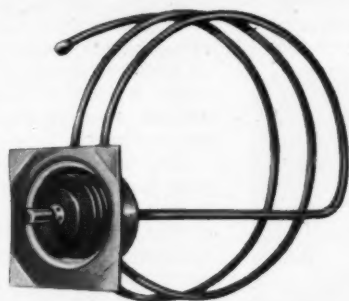
Light-Duty Conveyor Chains

462

Bulletin No. 6158P, 40 pages, covers a line of light-duty conveyor chains. Application and selection information is featured for Rex chains used in handling bottles, cans, jars, food, metal parts, components, packages, cartons, boxes and light-to-moderate loads. Other information given describes steel "TableTop" and "Plate-Top" chains, as well as nylon "PlateTop". Chain Belt Co., Box 2022, Milwaukee 1, Wis.

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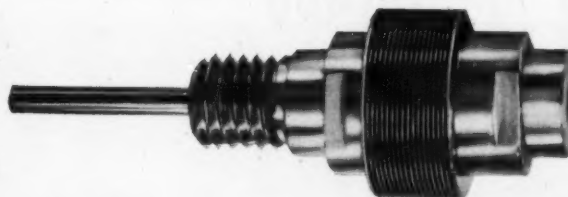
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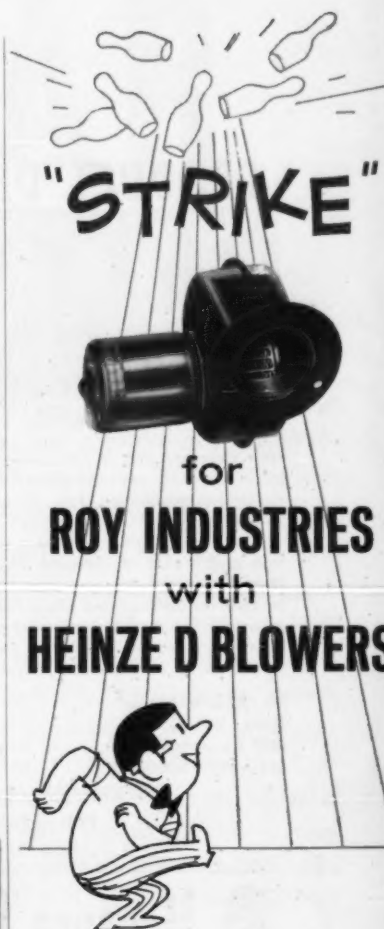
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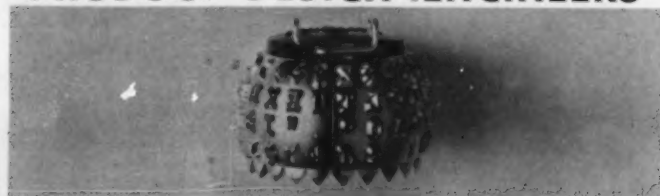
Roy Industries of Nashua, New Hampshire, manufacturers of bowling ball return equipment have a blower for drying a bowler's hands — with forced air instead of unsanitary towels. Roy selected the Heinze D Blower because of its compact size and high velocity (3200 rpm). These features also make the D Blower ideal for a variety of cooling operations — such as in electronic equipment, vending machines, refrigeration and air conditioning units, photographers' dark rooms. Single unit delivers up to 55 cfm, double unit 100 cfm. Both units are powered by long-lasting, trouble-free 2 pole induction motor with hp ratings from 1/150 to 1/100.

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LITERATURE

Flush Pushbuttons

463

"Oil-Tite" flush pushbuttons are detailed in an eight-page catalog. Made to requirements or available from standard stock, the new OT2 line of pushbuttons offers a complete spectrum of color. Custom-made, heavy-duty pushbuttons in the line are illustrated and described. Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

Portable Inspection Lights

464

Bulletin No. 6126 gives specifications, prices and a parts list for a line of portable inspection lights. The four-page folder gives data on a new jacketed ballast that meets immersion and explosion qualities of MIL-E-5272A. The units have particular application for the aircraft, missile and automotive industries. Day-Ray Products, Inc., 1133 Mission St., South Pasadena, Calif.

Portable Lighting

465

A complete line of portable lighting for office, shop and home is illustrated in a 12-page catalog. The brochure covers incandescent desk lighting, fluorescent desk and drafting lamps with either fixed, "E-Z" swing magic arm or feather-touch control arms and the "Magniflex" lamps for magnified fluorescent illumination. The new "Dualite" with both incandescent and fluorescent bulbs is featured. Acme Lite Products, Inc., Congers, N.Y.

Radio Frequency Interference

466

Analysis and control of RFI (radio frequency interference) in military and commercial electronic equipment systems and subsystems are discussed in a 12-page brochure. "What is RFI?", "What is RFI Caused By?", "What are the Effects of RFI?" and "What Can Be Done to Achieve RFI Free Electrical Equipments?" are among questions answered in the catalog. Hallicrafters Electronic Compatibility Labs., 4401 W. Fifth Ave., Chicago 24, Ill.

Spring Washer Engineering Data

467

Technical Bulletin SW-2, eight pages, presents engineering data on Belleville, Belleville "Sawtooth", ARC spring washers and three-wave spring washers. The information given is intended to aid in the selection by type and size of the correct washer for a specific application. The bulletin concludes with a description of the company's embrittlement-free zinc-plating process. George K. Garrett Co., Inc., Torresdale Ave. at Toblut St., Philadelphia 36, Pa.

Precision Balls

468

Technical data on the company's full line of precision balls include AFBMA definitions, cross-reference charts, a master table of ball grades and tolerances, and information on how precision balls are made. The 14-page catalog describes balls of high-carbon chrome alloy, stainless steel, K-monel, aluminum, naval brass, bronze, carbon steel, glass and plastics. General application material is given along with characteristics and properties. Hartford Steel Ball Co., 12 Jefferson Ave., West Hartford, Conn.

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Joint and Coil Designs 469 for Induction Soldering and Brazing

A 12-page review contains an article on joint design for soldered or brazed joints made by induction heating. Typical joint and coil designs are shown schematically and a chart gives the influence of joint thickness on tensile strength. Vol. 1, No. 5 of the High Frequency Heating Review also contains design information on fixtures for induction joining and induction brazing and soldering applications. Lepel High Frequency Labs., Inc., 55th St. & 37th Ave., Woodside 77, N.Y.

Data on Servomotors, 470 Motor Generators and Synchros

A revised edition of this engineering handbook details the theory, performance, application, construction and testing of rotary-wound components, synchronous motors and all types of high-performance synchros and resolvers. The 60-page brochure, entitled "Technical Information for The Engineer—Servo Motors, Motor Generators, Synchros", contains tabulations on operating characteristics for more than 250 different rotary-wound components used in servosystems and computers. Gearhead data complete the handbook. Kearfott Div., General Precision, Inc., 1150 McBride Ave., Little Falls, N.J.

Planar Devices 471

Catalog SL 300/2 details the technology of the planar process, developed by the manufacturer, which results in oxide-protected junctions. The 12-page catalog shows how the process builds in an unprecedented degree of reliability in the new devices. Performance characteristics and a planar/ mesa performance comparison are given. Catalog SL 206/1, 12 pages, shows the parameters and electrical characteristics of planar transistors and diodes, including diode pairs and quads; the schematic diagram and lead configuration of 33 popular special products, and diagrams and general operating characteristics of the company's micrologic elements (integrated functional digital building blocks). Fairchild Semiconductor, Div. of Fairchild Camera & Instrument Corp., 545 Whisman Rd., Mountain View, Calif.

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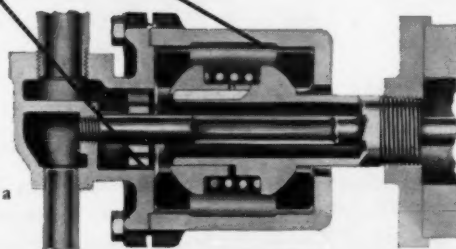
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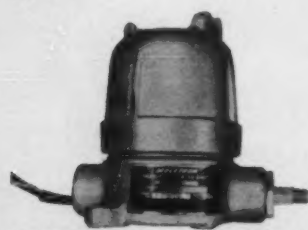
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Circle 44 on Reader-Service Card for more information

TECHNICAL PAPERS

You Can't Measure Data With Calipers—Or Can You?

Robert Pintar, Beckman/Systems Div.,
Beckman Instruments, Anaheim, Calif.

In order that certain information about an event be conveyed to man, it is necessary that the desired aspect of the event be converted to a form that is consistent with one or more of the five senses. In general, an intermediate step is involved in this conversion where the desired aspect of an event is converted to a form that we define as data. This leads to the more general definition, stated as follows: data is defined as a symbolic structure of an inaccessible event where the structure bears certain relationships to the event. The form that the data takes is generally one that is convenient to transmit and store. Once the data are generated, the next task is that of conversion of the data back to information. This is known as data processing. The final step is the interpretation of the resultant information.

In order to convert data to meaningful and reliable information, it is necessary to know the quality of the data. This point cannot be over-emphasized. In this space age with reconnaissance satellite systems and programs designed to put man in space, decisions based on collected data will affect the safety of men in space, whole nations and all mankind. As man's survival is dependent upon these decisions, the information from which these decisions are made must be of high quality and the degree of quality must be known.

Error Sources

Quality control of data is the determination and maintenance of (1) the particular aspect of the event that the data represent and (2) the degree of correspondence between the data and that particular aspect of the event. In general, the aspect of the event in question may be determined by careful consideration of the specific type of transducer used, as well as the way in which it is applied.

When the event represented by the data has been established, the next task is to determine the correspondence between the data and the event. While the correspondence may be determined theoretically, errors are introduced when the transducer is constructed. In voltmeters, errors arise because of friction in the bearings, non-linearity results from nonuniformities of the magnetic circuit. In general, the errors can be grouped into (1) systematic errors and (2) random errors.

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Fig. 1 RANDOM VARIATION FREQUENCY SPECTRUM

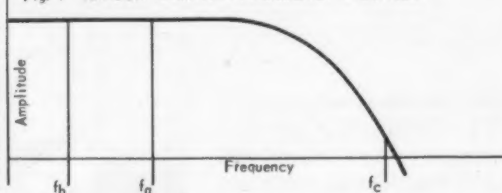
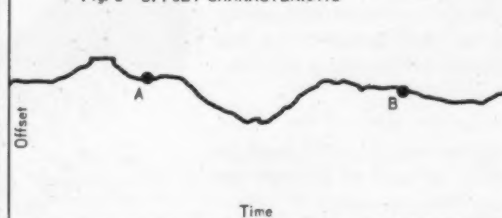


Fig. 2 OFFSET CHARACTERISTIC



Systematic errors are those that are relatively stationary with respect to time, and include errors resulting from offset, linearity and gain. Systematic errors may be determined by experimental determination of all components. This usually is done by the measurement of some known quantity or calibration.

Random errors are those that are purely random in nature and are independent of any measurement. Major contributors of random errors in a well-designed system are amplifier noise, thermal noise and contact noise. Random errors may be minimized by the application of statistics. These tools can be used effectively; however, the application of calibration and statistical processes must be used with caution.

Calibration

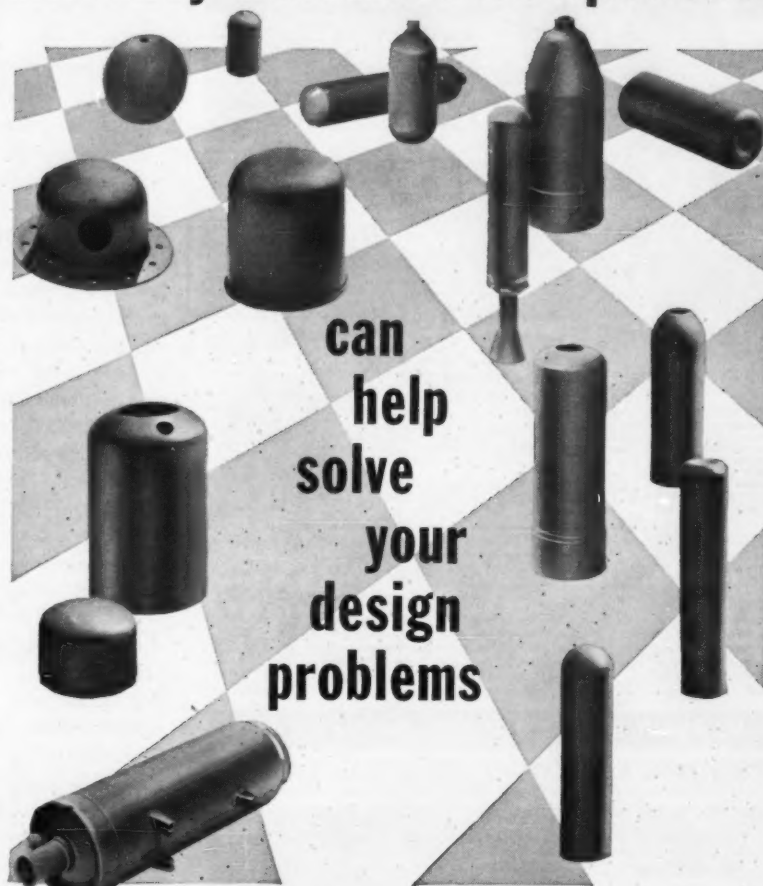
Calibration is a convenient way to determine the characteristics and accuracy of the equipment involved. The purpose of calibration is to learn the constant or offset errors and also to gain insight on random errors. The random error may include the entire frequency band from random variations as slow as a cycle per day or month, and slower to those limited by the upper frequency limits of the equipment.

To determine initially the status of a piece of measuring equipment, calibration should be performed continuously until the characteristics are determined. Since a finite amount of time is required to obtain a single reading, continuous calibration consists of a number of discrete points. If the results of the calibration were plotted, then the highest frequency component contained in the resultant characteristic would be half the sampling rate.

Assuming that the reading determined in each discrete time interval is done so that it represents the average of all the random variations that occur within this time interval, then the plot represents

(Continued on next page)

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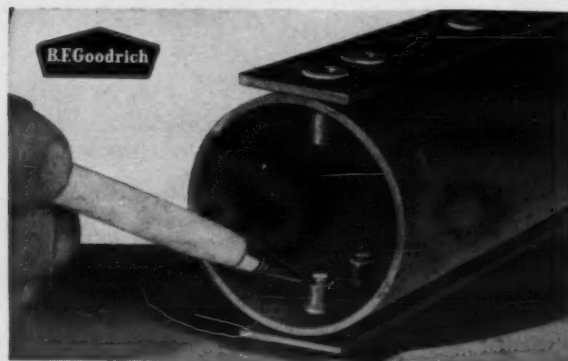
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Measure Data with Calipers? . . . Cont.

the constant and random variations up to certain
frequency determined by the sampling rate with
all higher random variations being averaged out.

If the frequency band of all random variations
that occur could be represented by the plot in Fig.
1, then all random variations below f_a have been
determined, while each discrete reading repre-
sents the mean of the random variations above
 f_a . This method may be used to determine the
characteristics of a piece of equipment initially,
and possibly on a periodic basis.

Since some time must be allowed for useful
measurements, the amount of calibration must be
reduced. This results in a band of frequencies
over which errors cannot be corrected.

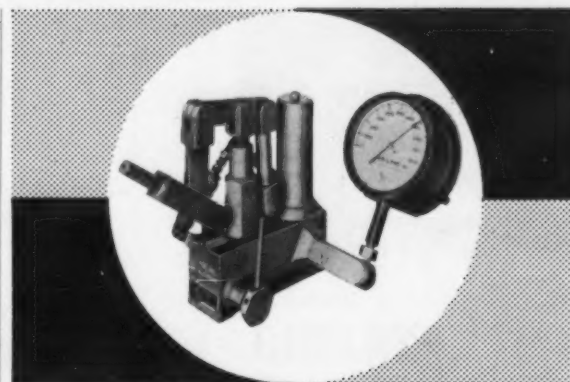
Variation below f_b may be determined through
calibration. Variations above f_a are effectively
averaged out and variations between f_b and f_a
are indeterminate. Consider Fig. 2 which repre-
sents the offset of a given measuring device
determined by continuous calibration. Points A
and B represent calibration points taken at a
predetermined interval. Obviously, variations
that occur at a frequency higher than half the
sampling rate cannot be determined. As the
frequency of calibration is reduced, the time for
useful measurements increases, however at the
expense of accuracy. The correct frequency of
calibration may be determined as follows: (a)
perform a continuous calibration and plot the
results, (b) determine the frequency spectrum of
the results and (c) determine the error versus
frequency for the required confidence level.
From the information and the required accuracy
of the measurement, the frequency of calibration
may be determined.

The way in which a measurement is made is
dependent upon the characteristics of the measur-
ing device, the source and magnitude of each
error source and required accuracy of the deter-
mination. Each case must be considered sep-
arately so that a good compromise between
equipment, measuring procedure and sample
size may be achieved.

Conclusion

You can put a caliper on data. The caliper is
knowledge. Knowledge of equipment status from
initial generation to final display. Equipment
status can be determined by the application of
calibration and statistical techniques.

Abstracted from a technical paper presented at the 1961
Western Regional Conference on Quality Control, March
15-17, 1961. Copies of this paper are available from
Dr. Harry G. Romig, 351 Alma Real Dr., Pacific Palisades,
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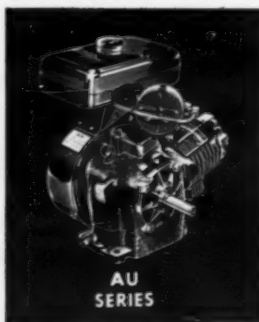
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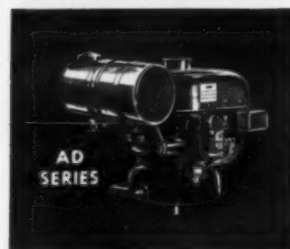
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Copies of these papers may be obtained by writing to technical society indicated. Addresses follow last item.

VIBRATION OF VERTICAL PUMPS: A. Kovats, Foster-Wheeler Corp., New York, N.Y.; ASME No. 61-Hyd-10.

Vibration of vertical pumps occurs often, in spite of the fact that calculations of critical frequencies have been made for design purposes. Use of only basic formulas of mechanics is an oversimplification of the problem. Only by taking into account all of the special modifying factors of the pump-driver system can sufficient accuracy be expected.

SOME EXPERIENCES WITH GROUND EFFECT DEVICES: C. A. Amann and J. W. Scheel, General Motors Corp.; SAE No. 370B; \$1; to SAE members, \$0.75. Ground effect devices supported on air films are basically limited in operating ground clearance to thousandths of an inch and must be run on especially prepared smooth surfaces. Devices supported on an air cushion, on the other hand, operate at greater clearance and are more tolerant of irregularities in the ground plane. If the ground effect principle is to find a niche in mass transportation, its potential would seem to be for a high-speed, automated thoroughfare.

CARBON AND GRAPHITE IN THE METALLURGICAL INDUSTRIES: N. J. Johnson, V. J. Nolan and J. W. Shea. Copies of this paper are available by writing on company letterhead to L. F. Granger, Advertising Manager, National Carbon Co.

Outlines and defines technical properties of fabricated carbon and graphite. Shows some of the relationships between properties and a few specific applications of carbon and graphite with emphasis on the end use of the materials. New methods of fabrication and manufacturing controls have provided entirely new graphite grades of unprecedented property levels and structural uniformity. Further improvements in fabricated carbon and graphite to meet future demands are assured through expanded research-development programs under way.

GENERALIZED MULTISTAGE AXIAL COMPRESSOR CHARACTERISTICS: G. L. Mellor, Asst. Professor, and T. Root, Senior Student, Princeton University, Princeton, N.J.; ASME No. 61-Hyd-14.

A method of calculating the off-design performance of multistage axial compressor characteristics that differs in concept from previous methods. A set of resulting calculations has certain general properties; it is independent of absolute stage work and flow coefficient, number of stages and annulus geometry. The set depends only on a stage characteristic "shape" which is normalized so that the work and pressure coefficient is unity when the flow coefficient is unity. One set of tabulated results can be applied to many different designs.

The American Society of Mechanical Engineers, 345 E. 47th St., New York 17, N.Y.
National Carbon Co., 270 Park Ave., New York 17, N.Y.
Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N.Y.

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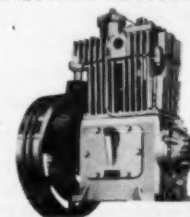
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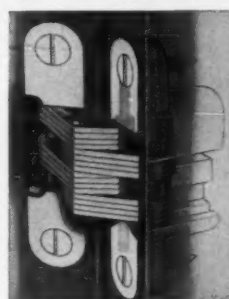


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Counters Program Perforating Punch Press

Edward W. Schrader, Western Editor

Counters program a punch press to automatically perforate a predetermined number of rows of holes; then the roll feed advances the work through the press a predetermined space margin. The cycle then repeats, perforating another row of holes. The space selector and multiplier counter will repeat the same spacing as before, or a completely different spacing may be preprogrammed into the automatic operation of the press.

All of the counters and the space multipliers will reset themselves after performing their function to give continuous operation of the press.

The control panel for programming the work consists of five "Microflex" counters for selecting the number of rows of perforations to be punched. The space selector and multiplier counter set the distance between perforated areas.

A roll feed actuated by a heavy-duty ratchet indexes to feed the work into the press. Limit switches placed at the desired spacing on a sector trip with each feed movement to supply an electrical signal back to the programming panel. This signal indicates the completion of a feed movement.

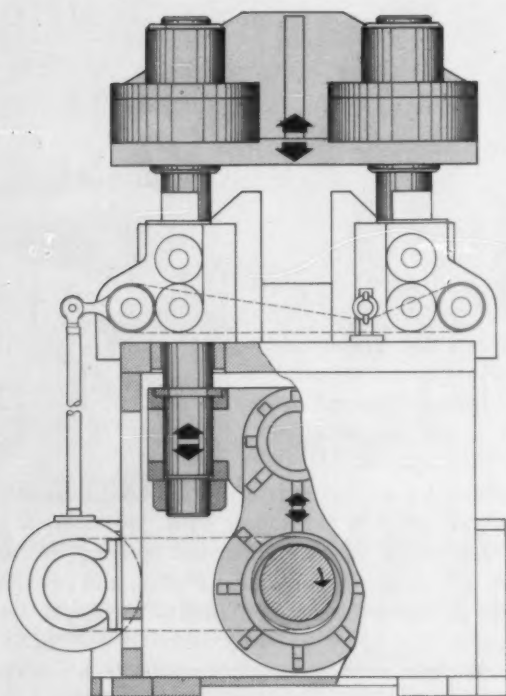
A double-acting air cylinder powers the roll feed.

The ram pushes on a quadrant to impart rotary action to the feed system.

The roll feed system is timed with each press stroke by means of an eccentrically driven push rod.

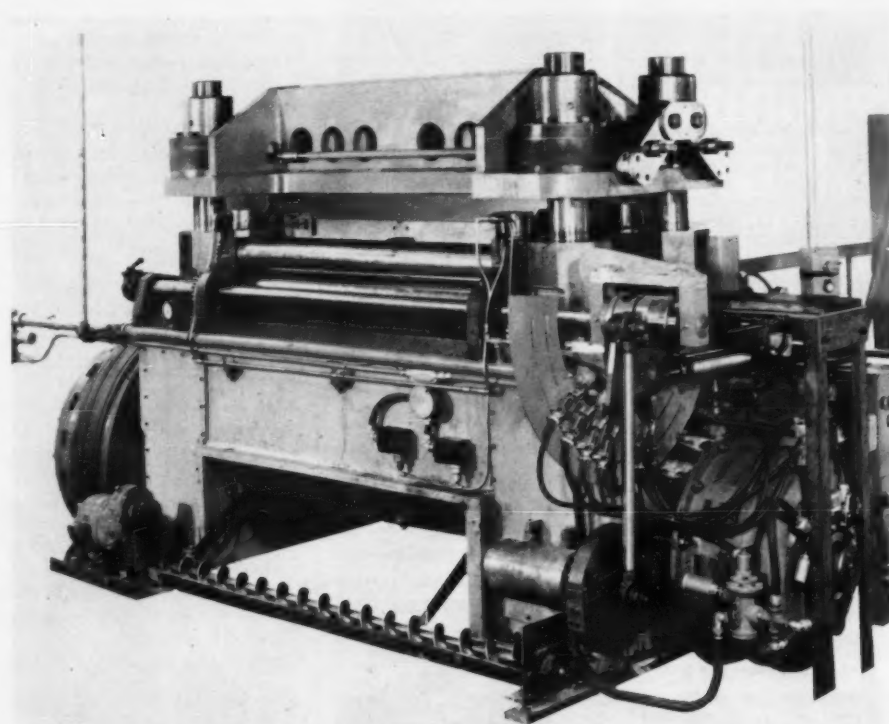
The 250-ton capacity press is underdriven by a double crank. The die mounted on the ram is pulled downward by means of the four corner posts to pierce the metal.

The Multi-Max perforating press is a design development of Diamond Machine Tool Corp., Pico-Rivera, Calif. Electrical circuitry was designed by Acromatic Products Co., Los Angeles, Calif.



UNDER-DRIVEN PRESS uses double crank to pull piercing die down for operation. Air-operated clutch connects variable-speed drive to flywheel and crank.

PERFORATING PUNCH PRESS has bed area of 36 inches by 54 inches. Stroke is 1 inch. Unit is powered by 40-hp variable-speed drive through V-belts to flywheel. Pneumatic clutch connects flywheel to underdriven crank shaft. Unit has spring-set brake with air release (fail-safe brake) and is designed for 90 to 270 strokes per minute.



47

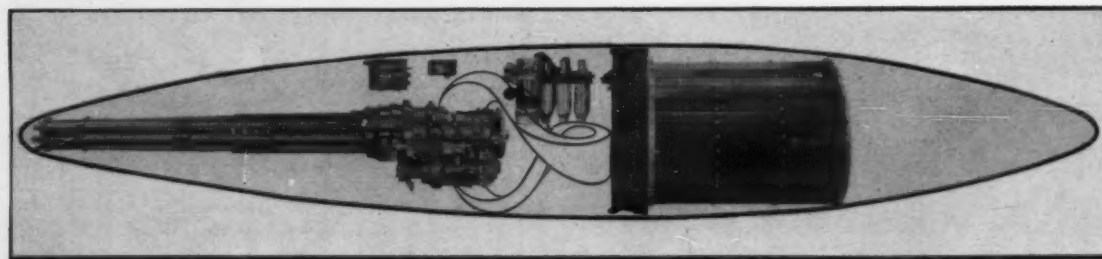
'Two-Level' Pressure Valve Regulates Solid-Propellant Power System

Victor W. Wigotsky, Eastern Editor

A solid-propellant power supply can be used to drive the Vulcan gun instead of an electrical or hydraulic system. Intermittent or continuous driving of the 20-mm gun is controlled by a "two-level" valve which regulates operation pressures in the power supply.

Developed on the principle of the 1861 Gatling gun, the Vulcan gun is a multibarrel, externally powered, automatic weapon capable of firing up to 6600 shots per minute. The gun arms several of the United States Air Force's aircraft such as the F-104 fighter-interceptor, F-105D fighter-bomber, B-52H bomber and B-58 supersonic bomber. Normally, the gun is contained within the aircraft and is driven by electrical or hydraulic motors from accessory power supplies. The solid-propellant power supply now facilitates compact pod installation and eliminates dependence on the aircraft for power to drive the gun.

The system is restartable and thus overcomes the limiting of solid propellant to single-shot applications. This is accomplished by regulating ignition of the grain from 12 small individual combustion chambers, rather than a single chamber, and by assuring steady-state firing through pressure control.



VULCAN GUN is shown with solid-propellant power supply in aircraft pod installation. In addition to reduced weight of drive system, solid-propellant power supply features consistent performance, ends hydraulic leakage problems and almost eliminates external power requirements. Compact power supply permits restarts on demand and regulation of output power under intermittent or sustained operation. Hot-gas control valve establishes desired pressure level for speed control of load, and system automatically provides timed ignition of new chamber. Power supply is highly versatile since variables of grain size and number of chambers permit flexibility for different power demands.

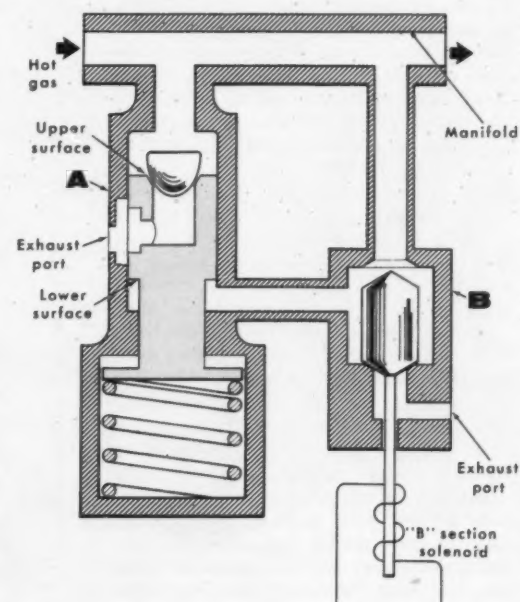
The "two-level" valve provides pressure control of gas within the line to regulate the speed of a hot-gas motor which drives the gun. Excess gas is vented if line pressure rises above a preset level. Also, in the event that a grain has been ignited and power no longer is required, the gas is automatically vented. The lower surface area on the piston in one section of the valve is open to gas pressure through a poppet-type solenoid valve in another section. This arrangement produces a force in the same direction as a reference spring and in opposition to the upper piston surface gas-pressure force. The result is an equilibrium condition to maintain high-level pressure. When motor speed reaches the desired level, a speed sensor at the gun rotor provides a signal to the solenoid valve, which then releases gas pressure on the lower piston surface area to the atmosphere.

The release of gas pressure causes a decrease of power and consequent reduction in motor/gun speed. If gun speed is low, the sensor signals the poppet valve to increase pressure. Excess gas flow, which tends to raise manifold pressure above normal (without gun overspeed), results in opening of the

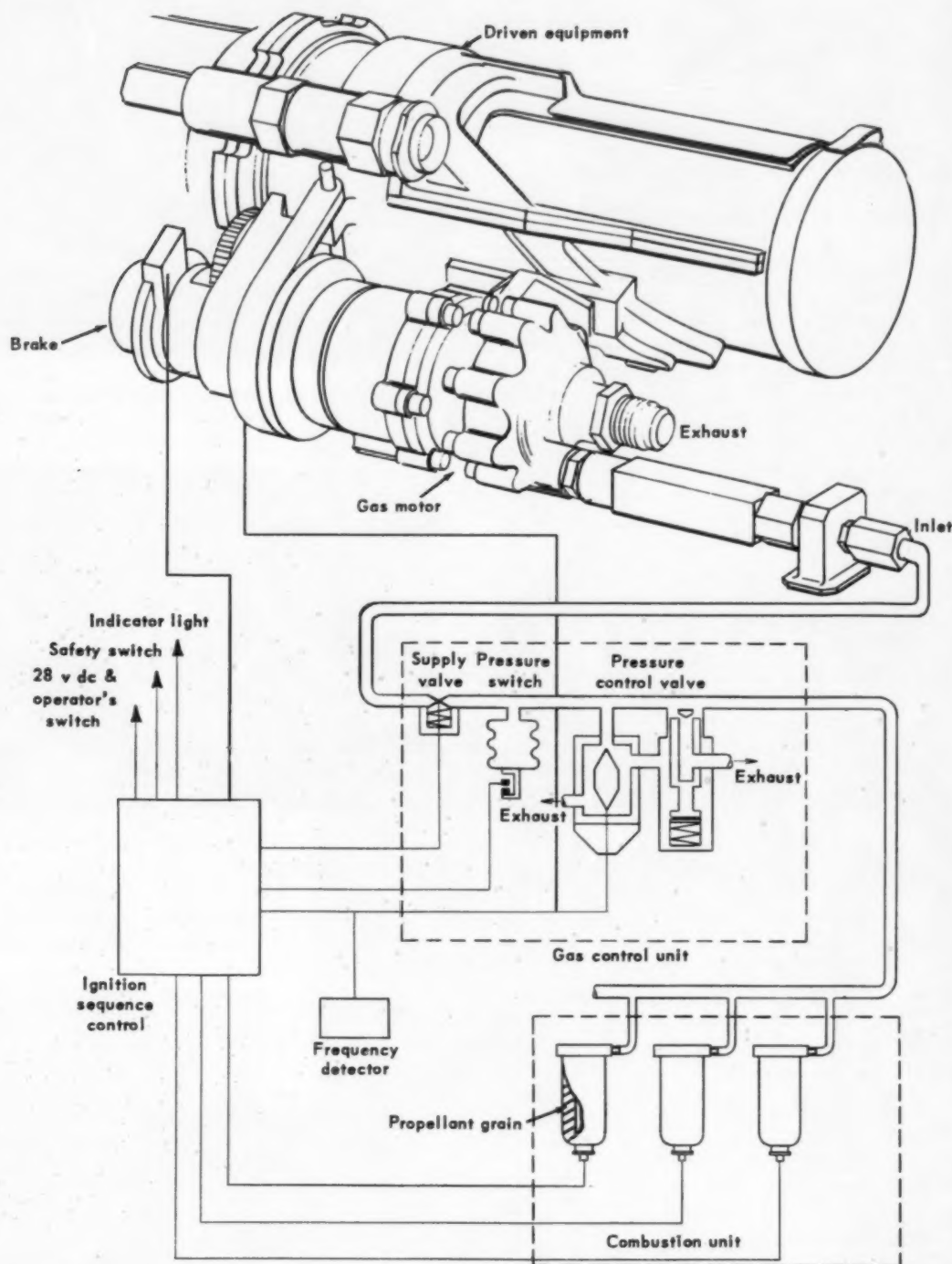
exhaust port in the upper piston surface. Thus, a high-level pressure is maintained when the upper and lower areas are used simultaneously, while a low-level pressure exists when only the upper piston area is used.

The system therefore makes no demands on the aircraft's hydraulic system and only a minimal demand on the electrical supply for controlling and actuating voltage. The method of packaging the total propellant power into 12 individual combustion chambers (for this particular application) provides sustained gun operation through use of the sequence mechanism, or individual firing of bursts of power for up to 1.5 sec each. The Vulcan gun builds up to maximum firing rate in 250 msec or less and is stopped by a solenoid-operated friction disc brake within 200 to 400 msec.

The solid-propellant power supply was designed by General Electric Co., Missile and Space Vehicle Dept., Missile Production Section, Burlington, Vt., under contract to, and in cooperation with, Springfield Armory of the United States Army Ordnance Corps.



PRESSURE CONTROL VALVE: Under normal conditions exhaust port in section "B" is closed and gas pressure acts on both sides of large piston. When speed of driven equipment is greater than desired, solenoid in section "B" closes passage from manifold and exposes lower surface of piston in section "A" to atmospheric pressure. This increases spring deflection and valve exhaust area in section "A". Further opening of exhaust port in section "A" then decreases manifold pressure and subsequent speed of driven equipment. In event of excess gas flow, manifold pressure may rise above normal level without causing overspeed. Section "A" then acts as pressure relief valve. Pressure difference moves piston down and further opens exhaust port in "A".



BASIC COMPONENTS of power supply are combustion, gas, ignition-sequence-control and drive units. Combustion unit consists of 12 refuelable chambers, connected by tubing to gas-control unit and driven equipment, with each chamber providing sufficient gas for minimum burst of 1.1 sec. Check valve in chamber base prevents backflow. Gas-control unit includes all required regulating devices mounted on single framework. Poppet-type, solenoid-operated supply valve is open during operation and closed when demand for power ceases. Pressure switch senses low-pressure limit in gas line

and completes circuitry to ignite another chamber when continuous power is desired. Pressure-control valve regulates speed of drive unit and relieves pressure within gas line if it rises above normal. Overall operation of power supply is governed by transistorized control of ignition sequence. This unit automatically ignites combustion chambers for continuous operation, selects and ignites first unused chamber when power supply is restarted and prevents overspeed of driven equipment by actuating solenoid in control valve.

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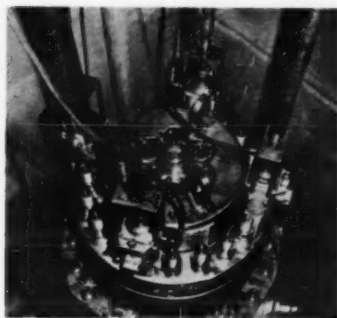
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OIL-DRUM-SIZED REACTOR for McMurdo Bay installation in Antarctica soon will be generating 1500 kw of electrical energy for use by U. S. Navy's support facilities.



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IDEAS IN THE NEWS

• **MACHINE WEIGHS, MEASURES AND MARKS** heavy oil-field pipe. Pipe is accepted in lengths of 50 ft 2 inches and in 4-1/2 to 10-3/4-inch dia. The machine then measures to within $\pm 1/2$ inch, weighs it to within 1/10 of 1 percent and automatically stencils the information on each pipe. The machine also counts the total pieces, computes the weight per foot, indicates and prints the total accumulated weight and length and performs other functions. The machine measures 65 ft overall and consists of a complete mechanical installation for mill handling of the heavy pipe, as well as a special-purpose computer and controls. Pipe entering the system is picked off loading arms by a synchronized transfer mechanism. Entering the first of two stations, it is supported for length measuring, weighing and counting. Feeler arms move against the ends of the pipe and a differential servo system translates the distance to an electrical signal proportionate to length. Weight then is checked by load cells with a null balance detecting system. After weighing, the pipe moves to a second station where stenciling is done automatically from an overhead, air-operated platform. Weight, length and other abbreviated data are marked in accordance with American Petroleum Institute code requirements. A memory device permits processing of two pipes at once, one pipe being stenciled while a second pipe is being measured and weighed. If a pipe is found which does not meet API specifications, the machine stops and signals the operator. The American Petroleum Institute requires that heavy oil-field pipe meet certain specifications—that the weight per foot and certain other data be stenciled onto each pipe. The code requires that the weight be held within $-3-1/2$ per-

(Continued on next page)

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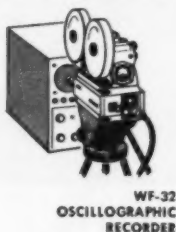
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... the newest FASTAX in the wide line of Wollensak
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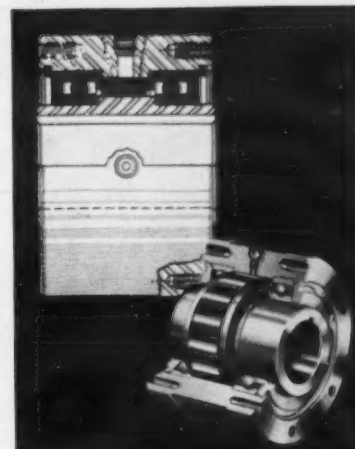


ARROW SHOWS load cell at center of weigh bridge in automatic pipe-weighing machine. Six cells are used in the weighing system which provides accuracies of 1/10 of 1 percent on pipes which may weigh up to 2999 lb each.



AUTOMATIC MACHINE weighs, measures and stencils oil-field pipe at rates of one piece every 18 to 36 sec. The machine requires only one operator and is adaptable to heavy tubular or flat-mill products.

cent to $\pm 6\frac{1}{2}$ percent of the nominal weight per foot. To play safe in meeting tolerances, pipe producers lean toward the heavy side, thus "giving away" tons of steel. While the code permits the variation from nominal weight per foot in the manufacture of pipe, weight of the total footage on a given order cannot vary from nominal by more than $1\frac{1}{2}$ percent to still meet API carloading requirements. Also, no more than 5 percent short length can be loaded on any one car. The machine's more accurate electronic weighing and measuring system substantially eliminates the costly job of segregating pipe to meet shipping requirements. In addition, only one part-time attendant is needed, against crews of four to eight men formerly required for weighing, measuring, tallying and stenciling pipe length. The system is believed a major first step toward eventual full automation of pipe mills and toward the automatic loading of boxcars. The automated pipe-handling machine was developed by Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.



For indexing rates
to 1200 strokes/min.

HPI Clutches

Whenever indexing requirements exceed 150 strokes per minute or 90° per stroke, then Formsprag HPI clutches present the ideal solution. Proved the finest indexing clutch on the market today!

- Torque capacities from 140 to 13,500 lbs. ft.
- Bore diameters from .500" to 6.000".
- More torque for a given size and weight.

Write for
Formsprag Catalog 105B



**FORMSPRAG
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23605 HOOVER ROAD, DEPT. 124
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Precision Power Transmission Products
Circle 61 on Reader-Service Card



10,000 VARIATIONS...

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Other spring fasteners may *look* like Tinnerman SPEED NUTS. But only those stamped with the T-mark really *are* SPEED NUTS, made to Tinnerman's high, precise standards of reliability. Tinnerman quality controls are the most stringent in the industry. And only Tinnerman stocks a *half-billion* SPEED NUTS... is tooled to turn out 10,000 variations... develops 25 *new* designs each week. Protect your product's good name by insisting on genuine SPEED NUTS. Stamped with the Tinnerman "T"—the mark of total reliability. Tinnerman Products, Inc., Department 12, Box 6688, Cleveland 1, Ohio.

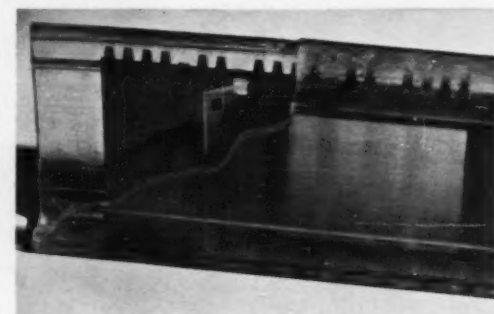
CANADA: Dominion Fasteners Ltd., Hamilton, Ontario.
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 FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine).
 GERMANY: Mecano Simmonds GMBH, Heidelberg.



Circle 62 on Reader-Service Card for more information

IDEAS IN THE NEWS

• **DISPLAY SYSTEM** based on photo-optical quality and permanence as well as central image generation with localized random access storage is described by R. L. Kuehn, Aeronutronic Div. of Ford Motor Co., at the Eastern Joint Computer Conference. Dataview, a general-purpose data-display system, is part of the U. S. Army ARTOC project.

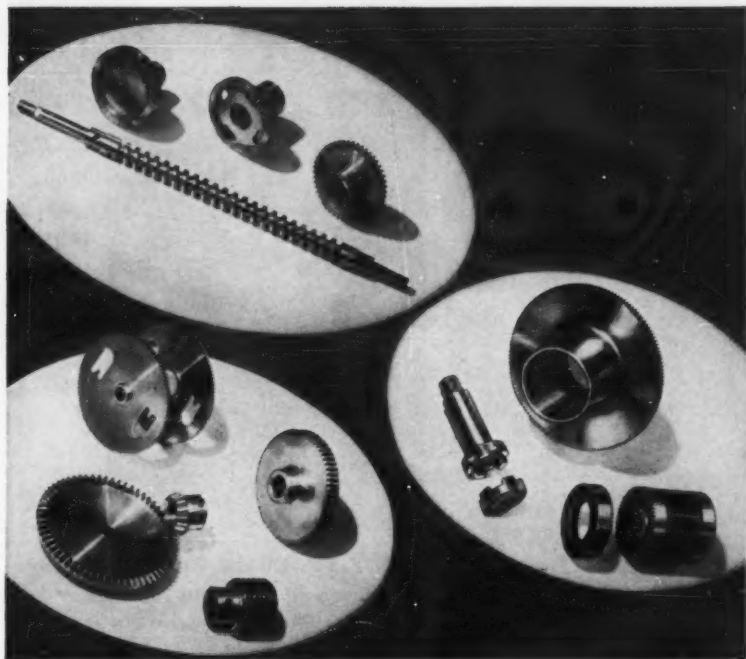


Data is stored on film slide files. Film material is bonded to a steel blade having 30 teeth on one edge which are selectively removed for coding. Clearance holes in the blade provide means of registration with pair of film sprocket holes.

The display generator produces and distributes the finished slides on a signal input, which is a serial-binary, with eight bits per word to conform with Army FIELDATA format. Four words define completely any unique deflection position of the cathode-ray tube spot, its brightness, size and other requisite data.

When a slide has been made, it is delivered to the distribution module, falling past a series of 12 deflecting gates. After the last scheduled slide is in place, air pressure is applied to the pneumatic tubes. A flap of film is left unbonded to the steel carrier blade. The air pressure in the plastic tubing lifts the flap, partially sealing the tube to propel the slide with the air stream. Velocities of 50 fps have been achieved, and velocities of 100 fps are feasible. The pneumatic tubing is a plastic extrusion which may be formed with any desired bends to meet installation requirements.

The slide delivered to a large screen display may contain tabulated information, syntactical information or data referenced geographically to a map or other appropriate background. Several overlays are feasible. Five optical apertures are provided. One of these projects the map or other background which may be in full color.

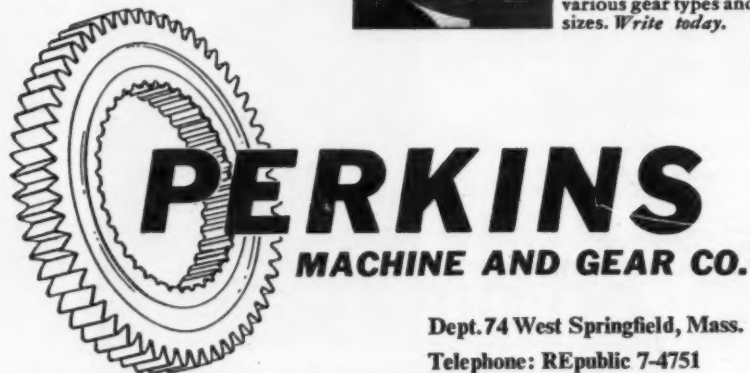


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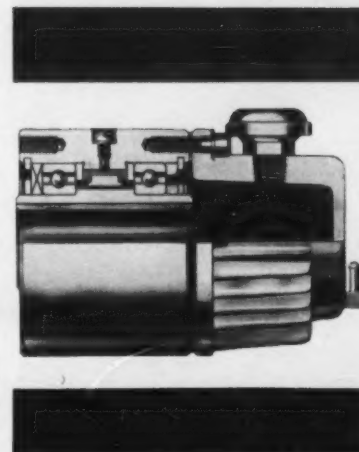
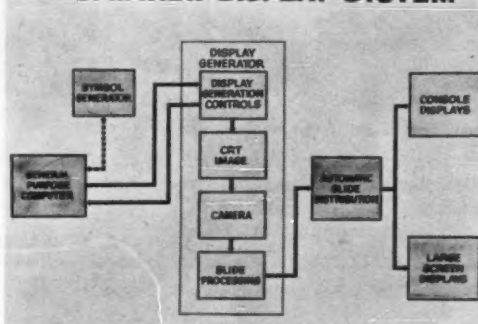
At the display unit, slides are stored in a magnetic receiver, self-aligned by permanent magnets. Access for retrieval is essentially a random process and is based on the keysort principle. Activating the desired decimal code at the control panel causes keybars to extend along the entire stack length. The appropriately notched slide is free to move by one tooth pitch, all others being locked in place. The slide is picked up by a transfer mechanism which carries it to the intended projector aperture. The entire retrieval action takes less than 3 sec.

The rear projection screen measures 7 by 9.3 ft.

A special condenser distributes the light in the slide aperture so that focus and distortion are not measurably different from the center to the corners of the screen. Of the available luminous flux emitted from the lamp, better than 30 percent reaches the screen.

E. W. S.

SIMPLIFIED DIAGRAM DATAVIEW DISPLAY SYSTEM



Prevent Runback of Conveyors and Similar Equipment

HSB Clutches

Eliminate reverse rotation on conveyors, transfer machines and similar equipment with precision built Formsprag HSB, high-speed backstopping clutches.

- Effective seals, oil reservoir with sight glass and filter breather add up to reduced maintenance.
- Select torque capacities from 140 to 1900 lbs. ft.
- Choose bore diameters from .500" to 2.750".
- Exclusive Formchrome sprags permit more capacity for given clutch size and weight.

Write for Catalog 105B.



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Precision Power Transmission Products

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There's a quality difference in any Schrader Air or Fluid Product

EXAMPLE: Schrader Square-end Cylinders not only have quality built into every part, but feature many extras. For instance, the unique cartridge-type bronze bearing assembly (A) is easily removed by releasing just one retaining ring—no need to dismantle the entire cylinder for bearing maintenance. Special "step" design cylinder seal (B) assures perfect alignment and positive seal without danger of gasket damage. Below surface cushion adjusting screws (C) are protected from damage but fully accessible. They lock to eliminate loosening due to vibration.

Interchangeable with all JIC cylinders, Schrader also pro-

vides a variety of mountings. Special bushings are available for bone-dry piston rod in hydraulic operation.

ANOTHER EXAMPLE: Schrader's new direct action Hydraulic Gauges without mechanical linkage (A) eliminate fatigue failure of internal parts. They can withstand 100% overload without damage to accuracy, and are triple-damped (B) to eliminate indicator oscillation from pump pulses, surges, or shock that would damage other types. Can be maintained and calibrated easily in the field. PSI pressure ranges 0-500, -1500, -3000, and -5000.



This new Schrader catalog is available at your Schrader distributor, who is stocked with the complete range of sizes and types of Schrader air circuitry products. Consult the Yellow Pages or write Schrader.

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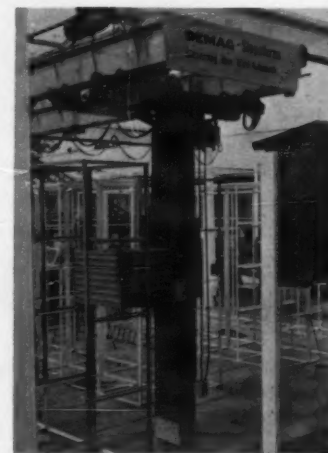


• **SUSPENDED-COLUMN CRANE** automates stacking of standard containers in large warehouses with operation centralized at a control console. The new system offers maximum utilization of storage space and needs only one operator.

Storage compartments are labeled by three digits for alley, position along alley and compartment level. Crane position is monitored by sensors along the overhead tracks and compared with a location number dialed on the control console. Differences between current and preset positions result in actuating signals to the crane motors. Shortly before reaching its target, the crane can be made to shift to slow speed.

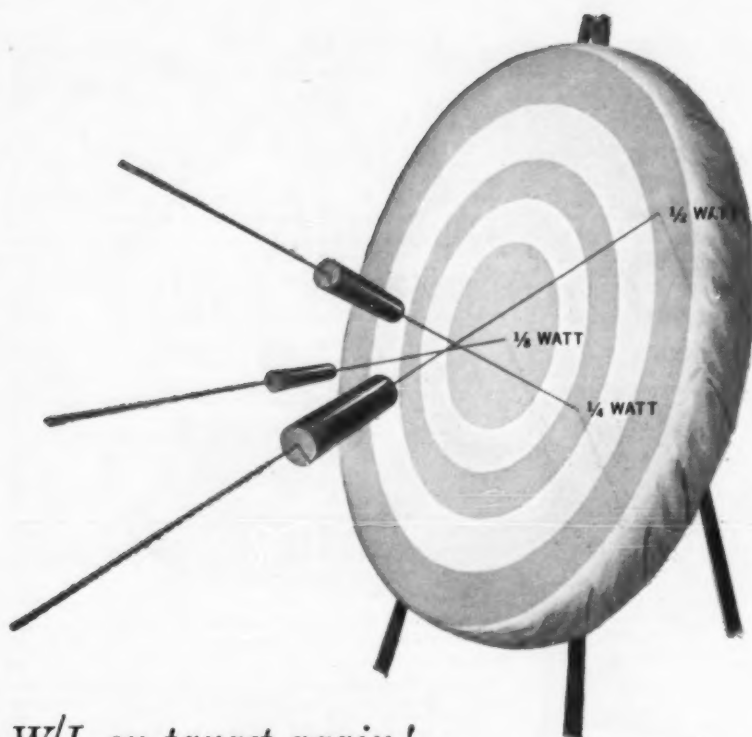
Forks or clamps travel vertically on a central box column capable of a 90-deg rotation to either side. Required alley width is 5 ft 3 inches, stacking height is up to 33 ft. The automatic stacker crane has a 4-ton maximum load and is a development of Demag-Zug GmbH, Wetter (Ruhr), Germany.

R.F.S.



DETAILS of crane drive and box-manipulating mechanism.

(Continued on next page)



W/L on target again!

New METOHM line exceeds MIL-R-10509D

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Available in 1/4, 1/2 and 1/2 watt sizes, W/L METOHM precision resistors feature the highest degree of built-in reliability and operating stability. Temperature coefficients, over the range -55°C to +175°C, may be as low as ±25 parts per million. Standard tolerance ±1%. Tolerances down to ±0.1% on special order.

METOHM TYPE	MIL EQUIVALENT	RATED WATTS	OHMIC VALUES		MAX. VOLTAGE RATING
			MIN.	MAX.	
WL 60	RN 60	1/4	30	500K	250 V.
WL 65	RN 65	1/4	50	1 meg.	300 V.
WL 70	RN 70	1/2	50	1.5 meg.	350 V.

Write for complete specifications and a list of distributors. Ward Leonard Electric Co., 26 South Street, Mount Vernon, New York.

G. 10

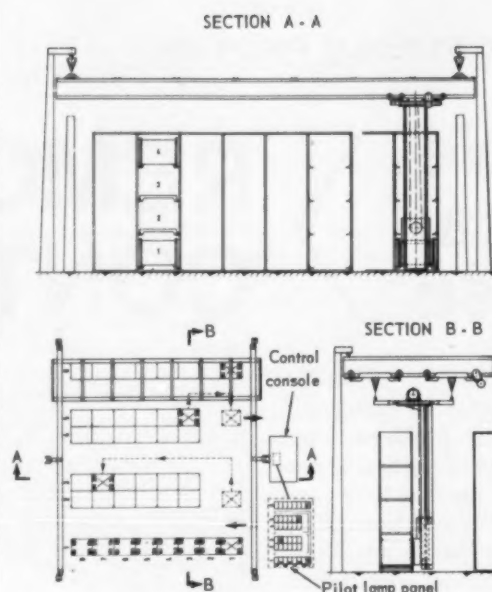


RESULT-ENGINEERED CONTROLS

WARD LEONARD ELECTRIC CO.

RESISTORS • RHEOSTATS • RELAYS • CONTROLS • DIMMERS

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NUMBERING of alleys, positions and levels. Crane location is displayed on pilot lamp panel in console. Solid arrows indicate flow lines for incoming and outgoing material; broken arrows give two examples of crane travel. Dimensions are in millimeters.

MEETINGS

Princeton, N. J.
Jan. 24-26

SECOND SYMPOSIUM ON THERMOPHYSICAL PROPERTIES, American Society of Mechanical Engineers, Princeton University.

Tempe, Ariz.
Jan. 29-Feb. 2

MEASUREMENT ENGINEERING SHORT COURSES, Engineering Center, Arizona State University.

New York, N. Y.
Feb. 5-9

41st NORELCO X-RAY ANALYTICAL SCHOOL, Philips Electronic Instruments, Div. of Philips Electronics and Pharmaceutical Industries Corp., Henry Hudson Hotel.

Dallas, Tex.
Feb. 6-7

ELECTROFORMING SYMPOSIUM, American Society for Testing and Materials, Statler-Hilton Hotel.

Los Angeles, Calif.
Feb. 7-9

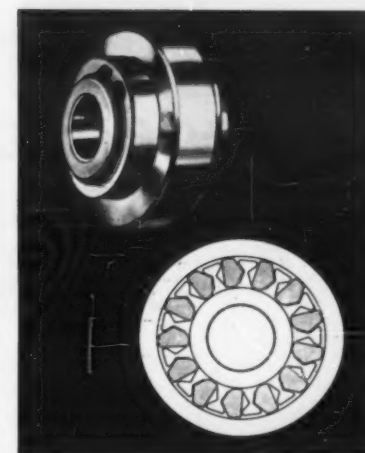
THIRD NATIONAL WINTER CONVENTION ON MILITARY ELECTRONICS, Institute of Radio Engineers, Ambassador Hotel.

Los Angeles, Calif.
Feb. 12-15

12th NATIONAL EXPOSITION OF THE AIRCONDITIONING, HEATING AND REFRIGERATION INDUSTRY, Biltmore Hotel.

Washington, D. C.
Feb. 19-22

FOURTH ELECTRICAL INSULATION CONFERENCE, American Institute of Electrical Engineers and National Electrical Manufacturers Assn., Shoreham Hotel.



Miniature Clutches

**FOR INDEXING,
OVER-RUNNING,
BACKSTOPPING**

Two models offer high continuous over-running speeds (FS-02 to 3450 rpm and FS-04 to 2400 rpm) and indexing rates up to 5,000 cycles per minute—15% higher than previous models.

- Model FS-02 has 4.5 ft. lbs. torque capacity with 250" bore and Model FS-04 has 17 ft. lbs. with .375" or 500" bores—tops for their size and weight.
- Each sprag is individually energized, insuring ultra-high performance.
- Gears, sprockets, etc. can be mounted to either outer race hub or to outside diameter of clutch.

Write for Catalog 105B



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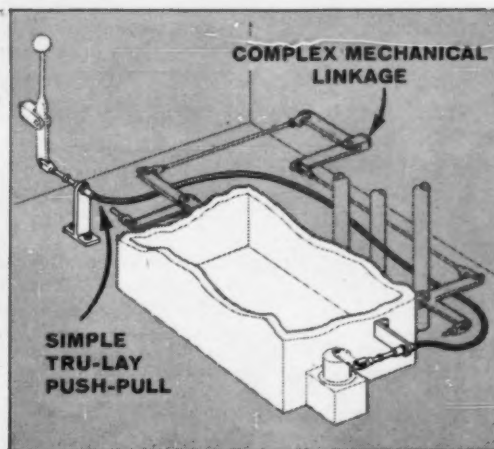
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**Dependable
Economical
Easy-to-Use**

• If your products involve remote control—electrical, hydraulic, pneumatic or direct—TRU-LAY PUSH-PULL FLEXIBLE CONTROLS can help solve your design problems. They provide positive remote control over long or short distances—up to 150 feet from the control point. Because they operate while flexing, they can snake around obstructions. They will not buckle. They're factory-lubricated for life, unaffected by temperature extremes. They are ruggedly constructed, easily installed and operated, sealed against dirt and moisture, and will handle jobs with as much as 1,000 lbs. input. PUSH-PULL CONTROLS are simple, have but one moving part, are noiseless, and give a lifetime of accuracy. Mechanical linkages, on the other hand, are complex. Unlike PUSH-PULL CONTROLS, they are made of many parts, wear at many points, and produce increased backlash, lost accuracy, and vibration rattles.

REMOTE CONTROL



CABLE SIZES AVAILABLE

Control Dimension	Minimum Recommended Radius in Inches	Maximum Input Load in Pounds (Dependent on Travel)
3/32"	2	30
1/8"	3	85-125
3/16"	5	115-175
1/4"	6	300-600
5/16"	8	700-1,000

PUSH-PULL DATA FILE SHOWS HOW TO SIMPLIFY, IMPROVE DESIGN



• Write for your PUSH-PULL Data File. It contains a complete set of engineering bulletins which describe in detail the operation of PUSH-PULL CONTROLS, their applications, features and advantages.

Operating Heads to Fit Your Design for loads up to 125 lbs.

Heavy Duty • For rugged duty, but where operation must be smooth and accurate. Meets all requirements for dependability and life.

Light Duty • Smooth, accurate, dependable performance at low cost. Your choice of several types of knobs.

Selective Friction • Amount of friction can be changed to meet individual requirements. Friction constant at any setting.

Position Lock • A slight turn of the T-type handle locks the control in any position. Two sizes for light and heavy-duty applications.

Micro Control • Push or pull the knob for instantaneous response, then rotate knob for vernier adjustment.



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6800-B East Acco Street, Los Angeles 22 • 929-B Connecticut Ave., Bridgeport 2, Conn.

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Pathon Cylinders are designed to give you a highly practical cylinder that fits into almost every situation where a hydraulic cylinder is needed. Maintenance is at an absolute minimum because Pathon Cylinders are simple and easier to take apart and put together.

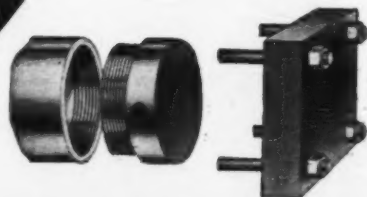


For the Designer

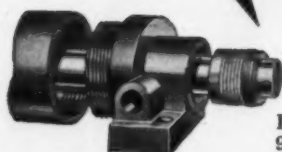
Pathon's compact design saves valuable space, makes your designing job easier, and gives your equipment added dependability with a modern, rugged appearance.

For the User

Pathon's screw thread head design gives you up to 40% more strength than most tie-rod cylinders. This increased strength means less maintenance, longer life.



For the Maintenance Man



Rod packing and bearing is externally replaceable and any part can be replaced without complete disassembly and the resulting "basket full of parts."

Pathon Hydraulic Cylinders are available in 9 mounting types, thirteen bore sizes—1½", etc., through 14", and three Series—for 1000 PSI, and 2000 PSI and 3000 PSI.

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Pathon MANUFACTURING COMPANY
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FLUID OPERATED AND CONTROL EQUIPMENT

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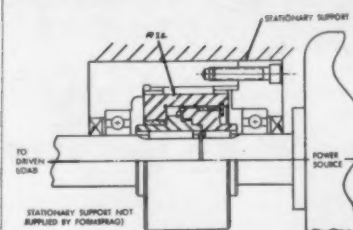
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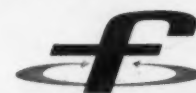
Reverse Locking Clutches

FOR POSITIVE LOAD POSITIONING

Sketch above shows why the load "stays put" once the power source is stopped. Any possible motion of driven load is arrested by R-L clutch acting on the stationary support.

- There is no backlash or feed-back torque in this high precision device.
- Long life is assured by high efficiency sprags.
- Simplicity of design means minimum number of moving parts.
- Compact units for torque capacities from 40 lbs. in. to 30,000 lbs. in.
- Bores and shaft sizes range from ¼" to 2½".

Write for
R_LL (reverse locking) literature



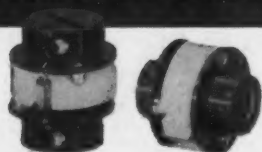
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COMPANY**

23605 HOOVER ROAD, DEPT. 127
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Precision Power Transmission Products
Circle 71 on Reader-Service Card

TIE
OF ACTON

MINIATURE FLEXIBLE COUPLINGS



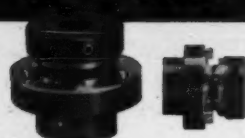
- FEATURE • No Backlash • Compactness and Lightweight**
- Accommodate both lateral and angular misalignment
 - Choice of types offer clamping or set-screw hubs

Type MPC-1 consists of two flanged aluminum hubs and nylon or Delrin discs with V-grooves that are displaced 90° with each other. Discs are fastened with stainless steel springs loading ball pivots against V-grooves. Dimensions $\frac{3}{8}$ x $\frac{1}{2}$ in.

Type MPC-2 has two cylindrical aluminum hubs, each with two ball pivots attached. Hubs are attached to a pair of flexible phosphor bronze discs which hold and load the ball pivots. Dimensions $\frac{3}{4}$ x $\frac{1}{2}$ in. Both types have range of bores to accept shafts from .120" to .250" and meet MIL-E-4970 and withstand -80° to 200°F and shock to 100 G.

TIE
OF ACTON

ADJUSTABLE SLIP CLUTCHES



- FEATURE • Adjustment over a wide torque range • Compactness and lightweight**

Type ASC-1 is $\frac{7}{8}$ x 1" Type ASC-2 Miniature is $\frac{3}{8}$ x $\frac{3}{8}$ " Both are constructed of aluminum hubs, Delrin on stainless steel clutch plates and stainless steel hardware. These rugged, high performance clutches are friction units to protect components against excessive or inertia shock loads. Range of bores to accept shafts from .120" to .250". These clutches meet MIL-E-4970 specs.

For details on couplings or clutches write

TIE

For further information write

TECHNOLOGY INSTRUMENT CORP.
533 MAIN STREET, ACTON, MASS.
8530 WILSHIRE BLVD.
BEVERLY HILLS, CALIF.

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PLANS AND CROSS-SECTIONS

Speaking of Speaking...

A SYNTHETIC SPEECH MACHINE that produces natural sounds and can sing a simple song or say a few sentences has been developed at the Massachusetts Institute of Technology and reported by Drs. M. H. L. Hecker, A. S. House and K. N. Stevens of MIT's electronics research laboratory.

An electronic device is used to represent the human body's major speech parts, which include the vocal tract, the larynx, the lips and the nasal cavities. The device electronically simulates the sound pathways of the vocal tract and the nasal cavities.

The electronic control circuits are given detailed instructions concerning what to do and when. These instructions are determined by analyzing natural speech sounds, studying X-ray motion picture films of persons speaking and knowing speech acoustics and phonetics.

With three nasal consonants added to the vocabulary of the machine, it can produce essentially all speech sounds occurring in the English language. The sample outputs of the MIT speech syn-

thesizer are "fully intelligible and sound reasonably natural".

A READING MACHINE that translates print into sound signals that blind persons can understand has recently been patented.

The device, created by John S. Abma, Lawrence J. Mason and David Reagan Rice, is called an optophone. It scans a line of printed material and translates the print into a sound signal and will give the same sound, even for different sizes of print, according to the inventors.

UNINTELLIGIBILITY is a characteristic of the female voice, according to an Air Force research study.

This flaw results from a lack of "harmonics" and may rule women out as broadcasters of routine transmissions for aircraft communications systems. Despite its vocal inferiority, the female voice could be useful in broadcasting warning transmissions since it has a "natural priority in commanding a man's attention," the team of male scientists discovered.

Twinkle, Twinkle Little Wind Meter

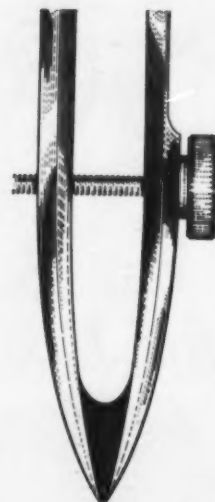
Twinkling stars are now being used to measure winds in the atmosphere.

Observations made at the University of Pennsylvania's Students' Observatory show that wind speeds in the upper atmosphere can be determined by the varying intensity of the star's light seen through a telescope's aperture. The twinkling is caused when star light is bent or distorted as it passes through turbulent atmospheric layers.

Wind speeds obtained from instrument-carrying balloons lofted into the air at the same time the telescopic observations were made checked quite accurately with computed figures.



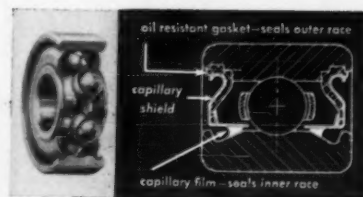
Do you know what an instant drawing is, Bates?



What do

Bow Pens have to do with Miniature Bearings?

They help us illustrate the principle behind our famous RMB Filmoseal construction. The ink in a bow pen is held in place by capillary action—so is the oil that forms the seal in the Filmoseal bearing. This means sealing is accomplished with no rubbing mechanical contact between rotating and stationary members. Here's how it looks:



The advantages are obvious:

**A SEALED BEARING WITH—
NO RUBBING FRICTION
NO INCREASE IN TORQUE**

You can specify RMB Filmoseal bearings to low cost ABEC 1, or 5 or 7 tolerances. Sizes available range from .1875" OD/.0550" Bore to .8661" OD/.3150" Bore. Immediate delivery. Write for complete data.

RMB



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☐ Employment ads—please give home address

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*(Offer limited to original equipment manufacturers. Expires February 28, 1962)





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COMPANY _____

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New materials prove ideal in handling

temperature extremes -350° F. to +750° F.

Working with two remarkably versatile elastomers, C/R Sirvene engineers are producing flexible molded parts for many vital fuel, lubricating, hydraulic and pneumatic systems. One, Viton-A*, can be compounded to produce parts that function dependably at 600° F., and for short periods up to 750° F. The other important feature of Viton compounds is their excellent resistance to corrosive chemicals, chlorinated solvents as well as both synthetic and petroleum base fuels and lubes. At the other extreme, C/R compounded Silastic LS-53** parts are providing low temperature operation down to -80° F. They also exhibit excel-

lent resistance to synthetic and petroleum base fluids up to 350° F., and function well in propane up to 500° F. For temperatures as low as -350° F., C/R recommends Teflon* compounds.

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* DuPont registered trademark

**Dow-Corning registered trademark

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